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INTRODUCTION.

The general meteorological conditions which prevailed over the United States during December, 1883, as compiled from the reports from the regular and voluntary observers of the Signal Service, and from the monthly reports of state weather services, are shown in this REVIEW. Descriptions of the storms occurring over the north Atlantic ocean are also given under "north Atlantic storms." On chart ii. are shown the approximate paths of the centres of ten storms which occurred over the north Atlantic during December.

The month was warmer than the average December over nearly the whole of the United States, the exceptions being the extreme northwest, upper lake region, New England, and the northern and middle Pacific coast regions, where it was colder than usual.

Large deficiencies in the average precipitation occurred in the states bordering on the south Atlantic coast, in the northern plateau, and in the north and middle Pacific coast regions; and a large excess occurred in the southern plateau. In other portions of the country the departures of excess and deficiency were not marked.

Eighteen atmospheric depressions, occurring within the limits of the stations of observation, are described under "areas of low barometer." The paths of the centres of fifteen of these are shown on chart i.

The phenomenal sunsets which were so extensively observed during the preceding months continued during December. Under "miscellaneous phenomena" will be found a summary of the reports relating thereto, that have been forwarded by the observers of the Signal Service.

In the preparation of this REVIEW the following data, received up to January 20th, 1884, have been used, viz.: the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and twenty-two Signal Service stations and fifteen Canadian stations, as telegraphed to this office; one hundred and fifty-six monthly journals, and one hundred and forty monthly means from the former, and fifteen monthly means from the latter; two hundred and sixty-three monthly registers from voluntary observers; forty-nine monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports, through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs, furnished by the publishers of "The New York Maritime Register;" monthly weather reports from the local weather services of Indiana, Kansas, Nebraska, Ohio, and Tennessee, and of the Central Pacific railway company; trustworthy newspaper extracts; and special reports.

ATMOSPHERIC PRESSURE.

[*Expressed in inches and hundredths.*]

The distribution of mean atmospheric pressure for December, 1883, determined from the tri-daily telegraphic observations of the Signal Service, is shown by the isobarometric lines on chart iii. The highest, inclosed by the isobar of 30.25, covers portions of the northern, middle, and southern slopes, and middle plateau. The highest barometric means occurring within those regions are, 30.28 at Salt Lake City, Utah, and 30.27 at Cheyenne, Wyoming, North Platte, Nebraska, and Fort Elliott, Texas. An isobar of 30.2 incloses the northern and middle plateau districts and the eastern Rocky mountain slope. Westward of this area of barometric maximum the mean pressures decrease to 30.06 on the north Pacific coast and to 30.07 in southern California. To the eastward of the area of greatest pressure the barometric means fall below 30.15 on the Texas coast, and below 29.95 over the Canadian maritime provinces, while over northern Georgia, western South Carolina, and southeastern Tennessee, the mean pressures exceed 30.2. An isobar of 30.1 is traced from Lake Superior southward to northern Illinois, and thence eastward to the New England coast. North of this isobar the pressures vary in the lake region from 30.02 to 30.1, and in the Canadian maritime provinces and New England from 29.92 to 30.03. The stations reporting the extremes for the entire country are: lowest, Sydney, Nova Scotia, 29.92; highest, Salt Lake City, Utah, 30.28.

Compared with the mean pressure of the preceding month (November), an increase has taken place in the Saint Lawrence valley, upper lake region, and, with a few exceptions, at all stations west of the Mississippi river. The greatest increase occurred in the upper Missouri valley and extreme northwest, where it varies from .15 to .19. In the Canadian maritime provinces, New England, and the districts east of the Mississippi south of the lake region, except in Florida, the mean pressures are lower than for November, the departures being most marked from northern Georgia to southern New Jersey, where they amount to .05. At Key West, Florida, the monthly mean is .07 higher than that for November.

DEPARTURES FROM THE NORMAL VALUES FOR THE MONTH.

Compared with the normal pressure for December, no marked departures have occurred, except on the north Pacific coast, where they range from .07 to .10 above the normal. In the extreme northwest, south Atlantic states, middle Pacific coast, over the eastern Rocky mountain slope, and the western plateau districts the mean pressure is slightly above the normal, the departures varying from .01 to .06. From the Missouri valley eastward to the New England and middle Atlantic coasts, and in southern California, the mean pressure is slightly below the normal, the departures ranging from .01 to .04.

BAROMETRIC RANGES.

The barometric ranges were greatest in New England, where they were unusually large. At Eastport, Maine, the monthly range was 1.86, which, with the exception of 1.90 at Fort Myer, Virginia, in 1878, is the largest that has been reported for December since 1877. The monthly ranges exceeded 1.25 at the most northerly stations from Minnesota westward to

Washington Territory. North of a line extending from the Oregon coast between Roseburg and Portland in a southeasterly direction to central Arkansas, thence northeastward to Lake Huron, and thence southeastward to the Virginia coast, the monthly ranges exceeded 1.00. As usual, they were least in Florida and Arizona, the smallest, .23, occurring at Key West.

In the several districts the monthly barometric ranges varied as follows:

New England.—From 1.42 at Block Island, Rhode Island, to 1.86 at Eastport, Maine.

Middle Atlantic states.—From .88 at Cape Henry, Virginia, to 1.44 at Albany, New York.

South Atlantic states.—From .38 at Jacksonville, Florida, to .86 at Kitty Hawk, North Carolina.

Florida peninsula.—From .23 at Key West, to .32 at Sanford.

Eastern Gulf.—From .51 at Pensacola, Florida, to .79 at Vicksburg, Mississippi.

Western Gulf.—From .81 at Galveston, Texas, to 1.06 at Fort Smith, Arkansas.

Rio Grande Valley.—From .75 at Brownsville, Texas, to .82 at Rio Grande City, Texas.

Ohio valley and Tennessee.—From .67 at Chattanooga, Tennessee, to .93 at Columbus, Ohio.

Lower lakes.—From .92 at Cleveland and Sandusky, Ohio, to 1.23 at Oswego, New York.

Upper lakes.—From .93 at Port Huron, Michigan, to 1.16 at Duluth, Minnesota.

Extreme northwest.—From 1.17 at Saint Vincent, Minnesota, to 1.47 at Bismarck, Dakota.

Upper Mississippi valley.—From .88 at Cairo, Illinois, to 1.23 at Saint Paul, Minnesota.

Missouri valley.—From 1.15 at Leavenworth, Kansas, to 1.38 at Fort Bennett, Dakota.

Northern slope.—From .90 at Cheyenne, Wyoming, to 1.32 at Fort Assinniboine, Montana.

Middle slope.—From .77 on the summit of Pike's Peak, Colorado, to 1.13 at Dodge City, Kansas.

Southern slope.—From .74 at Fort Stockton, Texas, to .89 at Fort Concho, Texas.

Southern plateau.—From .46 at Fort Grant, Arizona, to .62 at El Paso, Texas.

Middle plateau.—.92 at Salt Lake City, Utah.

Northern plateau.—From 1.44 at Dayton, Washington Territory, to 1.56 at Lewiston, Idaho.

North Pacific coast.—From .73 at Roseburg, Oregon, to 1.21 at Olympia, Washington Territory.

Middle Pacific coast.—From .60 at Cape Mendocino, California, to .77 at Sacramento, California.

South Pacific coast.—From .51 at San Diego, California, to .54 at Los Angeles, California.

AREAS OF HIGH BAROMETER.

Nine high areas have traveled across different portions of the country, and are described below. They were all well-marked and extensive. Number iii. produced low temperatures, especially in the Gulf states, where freezing weather was quite general on the 15th and 16th; in the Southern states the lowest temperatures of the month occurred during its movement. In the upper Mississippi valley and upper lake region, the lowest temperatures of the month generally prevailed during the passage of number v. on the 19th. In the lower lake region, middle Atlantic states and New England, number vi. produced the lowest temperatures on the 22d and 23d. Number viii. was accompanied by lowest temperatures in the Missouri valley on the 27th. In Washington, Oregon, Idaho, Utah, Arizona, Montana, Wyoming, Colorado, northwestern Texas, and western portions of Kansas, Nebraska, and Dakota, the minimum temperatures occurred during the presence of number ix. on the 30th and 31st. Number ii. developed in the Rocky mountain region; numbers iii. and vii. came from the Pacific coast; numbers v., vi., viii., and ix. advanced southeastward from the northwest territory.

I.—On the morning of the 1st this high area was central in Wyoming, and during the day moved southeastward, with a pressure slightly above 30.60, or .30 to .40 of an inch above the normal, toward the lower Missouri valley. During the 2d its progress was southeastward. On the morning of the 3d it was central in the upper Ohio valley, with diminished central pressure, and with temperatures slightly below the normal east of the Mississippi valley; the 3d and 4th it passed southeast beyond the middle Atlantic coast. Cautionary off-shore signals were ordered up at Indianola on the 1st, in anticipation of a "norther," but it did not reach the coast, although high northerly winds occurred from the Missouri valley to northern Texas.

II.—During the 3d this high-pressure area formed over the Rocky mountain region, and on the morning of the 4th was central in eastern Wyoming. Its movement on the 4th was eastward toward the lake region. The afternoon of the 5th it was central over Lake Superior, with the pressure about .25 of an inch above the normal. The morning of the 6th it covered the lower lake region and the middle Atlantic states, and later moved eastward over New England and Nova Scotia. Along the coast of Nova Scotia the pressure was about .60 of an inch above the normal on the morning of the 7th, after which it slowly disappeared to the eastward.

III.—The pressure increased in the Pacific coast regions on the 5th; it continued on the 6th, and extended eastward across the Rocky mountain region. On the morning of the 7th it was central in southern Idaho, with the Olympia barometer .51 inch above normal. The 7th and 8th, it extended its influence southeastward to the lower Mississippi valley, but continued highest in Utah; barometer at Salt Lake City, 30.69 inches, or .47 above normal, morning of the 8th. During the 9th, 10th, and 11th, with diminished pressure, it continued almost stationary as a barometric ridge reaching from southern Idaho over Wyoming, eastern Colorado, and western Kansas to northern Texas. The 12th, it apparently withdrew toward Idaho and Washington Territory, during the movement of the low-pressure areas on the Texas coast and from Manitoba southeastward. The 13th, it again moved eastward over Montana, and the 14th, southeastward over the country between the Rocky mountains and Missouri valley; p. m. barometer, 14th, at North Platte, 30.89 inches, or .66 above normal. A "norther" prevailed in Texas on the 14th. During the 15th it passed south over Texas and disappeared. Freezing temperatures accompanied it as far south as the central portions of the Gulf states and western portions of the south Atlantic states on the morning of the 15th; also in the larger portions of Texas and Louisiana, throughout Mississippi, Alabama, Georgia, and the south Atlantic states, and the northern portion of Florida on the morning of the 16th, where it fell about 20° below the normal. In anticipation of the "norther," off-shore signals were ordered to be hoisted at Indianola and Galveston midnight of the 13th, and at Key West morning of the 15th; all were justified.

IV.—Developed from number iii. on the 14th. It was central in Idaho on the 15th, with the temperature about 10° below the normal and the barometer about .50 inch above the normal. On the 16th it moved southwestward toward Oregon, Nevada and Utah, with diminishing central pressure, due to the advance of low-pressure number x., and on the 17th withdrew to western Oregon, where it lost its identity on the 18th.

V.—This area made its appearance on the 17th over the northwest territory, and advanced southeast over Montana and Dakota, following low area number x. On the morning of the 18th the temperature was below the normal from the upper lake region beyond the Missouri valley; 31° below the normal at Moorhead, Minnesota, and —28° at Minnedosa, Manitoba. During the 18th it extended its influence toward the Ohio valley and Texas, but with the highest pressure north of Dakota. On the 19th the highest reached from the upper Mississippi valley eastward over the lake region, with morning minimum temperature of —35° at Pembina, and 37° below nor-

mal at Moorhead. On the morning of the 20th the highest covered the Saint Lawrence valley; barometer above 30.50, or about .50 inch above the normal. During that and the following day it slowly disappeared eastward beyond the Canadian maritime provinces.

VI.—Advanced southeastward over the northwest territory and Manitoba morning of the 21st; minimum temperature at Qu'Appelle, —36°; midnight barometer at Minnedosa, 30.83 inches. The pressure was below the normal, and falling, in the Pacific coast and Rocky mountain regions, and caused this high area to move southeastward over the lake region during the 21st and 22d, with the temperature considerably below the normal from the Missouri valley to the New England and middle Atlantic coasts, and the northern portions of the Gulf states; minimum, —36° and —35° at Fort Garry and Pembina, respectively, or more than 30° below the normal, morning of the 22d. The 23d it passed eastward over New England; highest barometer at Montreal, 30.79 inches, or .65 above normal; minimum temperature from 20° to 30° below the normal; northerly gales were produced along the coast north of Cape Hatteras. During the 24th it disappeared beyond Nova Scotia.

VII.—This high area appeared in California onthe 23d, and, with a slight increase in pressure, extended southeastward to Texas on the 24th. Freezing temperature accompanied it in the interior. The 25th, it apparently withdrew toward California during the progress eastward of low area xiv. The 26th, it combined with number viii. and lost its identity.

VIII.—During the night of the 25th it advanced southward over the northwest territory and Manitoba, with minimum temperature of —37° at Qu 'Appelle and Fort Garry on the morning of the 26th. During the day it rapidly extended southward in rear of low area xiv. and in front of low area xv., and on the morning of the 27th it appeared as an extensive barometric ridge, reaching from Texas beyond Minnesota, with the pressure slightly above normal. The temperature fell considerably below the normal—at Moorhead, Minnesota, 43° below, or to —34°. On the 27th and 28th it moved southeastward over the Southern states, with freezing weather in the northern portions of the Gulf and south Atlantic states. On the 29th it remained stationary in the south Atlantic states, and disappeared eastward on the 30th in advance of low area xvi.

IX.—On the 28th, increasing pressure and falling temperature in the northwest territory and Manitoba indicated the approach of a high area. Its progress southward was impeded on the 29th by low area xvi., but the pressure also increased in the Pacific coast regions, and continued increasing on the 30th from the Pacific coast to the upper lake region; during the 31st it extended its influence to the western Gulf coast, where a severe "norther" began in the evening. At midnight the barometer at Qu 'Appelle was 30.99 inches, or more than .60 above the normal.

AREAS OF LOW BAROMETER.

The following table gives the latitude and longitude in which the centres of the several areas were first and last located, and the average hourly velocity of movement:

Areas of low barometer.	First observed		Last observed.		Average velocity in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
	° ′	° ′	° ′	° ′	
No. I.	51 30	96 00	47 00	58 00	30.5
III.	36 00	102 30	48 00	87 00	29.1
V.	51 00	95 30	45 30	60 00	31.2
VI.	52 00	107 00	43 00	75 00	40.0
VII.	48 00	97 30	47 00	59 00	23.7
VIII.	27 00	96 30	30 30	93 00	15.0
IX.	54 00	110 00	47 00	60 00	48.4
X.	51 00	107 30	51 30	67 30	43.8
XI.	31 00	97 00	33 30	86 30	27.5
XII.	39 30	71 00	46 30	58 00	35.4
XIV.	40 30	114 30	44 30	60 00	41.0
XV.	49 30	125 00	49 00	61 00	48.8
XVI.	48 30	125 30	51 00	98 00	37.5
XVII.	42 00	112 00	42 30	82 00	25.8
XVIII.	28 00	97 30	30 30	88 30	17.5

Mean hourly velocity, 33.0 miles.

Out of eighteen low areas, the tracks of the centres of fifteen are shown on chart i. The paths of three, numbers ii., iv., and xiii., were too far north to permit locating them. Along the Gulf and southern portions of the south Atlantic and California coasts no severe storms were experienced during the month. Number xv. was unusually severe from northern California and the north Pacific coast to Montana; also from the lakes and middle states northeastward beyond the Gulf of Saint Lawrence. In the lake region numbers i., vii., x., and xiv. were also very severe. Number ix. was an extremely dangerous storm along the New England coast, as the northeasterly gales were accompanied by heavy snow.

The display of signals at the lake stations ceased after the 15th, excepting Milwaukee, Ludington, Grand Haven, and Saint Joseph, on Lake Michigan.

I.—During its progress eastward it was accompanied by very light rains and snow in the lake region, Saint Lawrence valley, New England, and the northern portion of the middle Atlantic states, and light rains and snow in the Canadian maritime provinces. The southerly winds in its advance were only fresh to brisk, but the steep gradient between it and high area number i. produced high northwesterly winds in its rear from the Missouri valley eastward over the lake region to the Atlantic coast north of Cape Hatteras, which at places increased to gales. Maximum hourly wind-velocities: Yankton, nw., 34; Mackinaw City, nw., 36; Marquette, w., 40; Grand Haven, nw., 53; Erie, nw., 30; Kitty Hawk, n., 44; Delaware Breakwater, nw., 43; Block Island, n., 44; Eastport, nw., 39; Mount Washington, nw., 90 miles. Lowest barometer at Sydney, Cape Breton, morning of the 3d, 29.05 inches, or .91 below the normal. In the Ohio valley and Missouri the temperature rose from 20° to 30° above the normal on the 1st. Cautionary signals were ordered up at all lake stations and along the New England and North Carolina coasts, and off-shore, from New York to Cape Henry, on the 1st; warnings were also sent for the Canadian stations in the lake region, Saint Lawrence valley, and maritime provinces; they were very generally justified, as shown by the above velocities.

II.—This disturbance was scarcely felt within the limits of the Signal Service stations, and its path has not been charted. Its centre passed eastward over Manitoba on the 2d and 3d, thence north of the lake region, the 4th, and to the mouth of the Saint Lawrence on the 5th. Very light local rains or snow accompanied it from the lake region and Ohio valley eastward. No signals were ordered and not any high winds occurred.

III.—Falling barometer and increasing southeasterly winds along the Pacific coast on the 2d indicated the approach of a disturbance. During the 3d generally light rains fell in California, and at night in Arizona. The barometer at San Francisco fell to 29.76 inches, or .45 below the normal. The 4th, clearing weather followed in California, but light rains continued in Arizona, with high winds at places. During the 5th the rain-area extended eastward over the western Gulf states and the Missouri valley, but partly as snow from Colorado to western Dakota; the centre of the depression was in the northwestern corner of Texas at midnight; high winds were reported from western Texas. As it moved northeast toward the upper lakes, threatening weather, with rain, prevailed from the Gulf coast to the upper lakes, Minnesota and the Missouri valley, but changing to snow from Dakota and Minnesota to Colorado; also high winds and gales, especially in its western half. In the morning the barometer at Dodge City fell to 29.67 inches, or .58 below the normal. As it passed into Canada on the 7th, rainy weather accompanied it from the Gulf coast to the lake region, generally changing to snow from the Missouri valley to the upper lakes. During the 8th rain fell in the Atlantic states; a light "norther" was produced on the Texas coast in connection with high area iii. Maximum velocities: Cape Mendocino, se., 64; Prescott, s., 30; Fort Concho, sw., 42; West Las Animas, nw., 44; Keokuk, se., 36; North Platte, w., 36; Duluth, nw., 36; Grand Haven, sw., 32; Erie, s., 32; Buffalo, sw., 36; Indianola, sw., 32, and n., 36 miles. At midnight of

the 5th signals were ordered for lake stations from Duluth to Cleveland, and the afternoon of the 6th for the remaining stations on lakes Erie and Ontario, and warnings sent for the Canadian stations in the lake region and Saint Lawrence valley; they were well justified, but were lowered too soon along Lake Ontario morning of the 8th.

IV.—The southern edge of this storm was felt on the 4th in the north Pacific coast region where threatening and rainy weather prevailed, with high southerly winds on the coast. The 5th, it rapidly moved eastward over the northwest territory and Manitoba, causing high southerly winds. During the 6th it probably combined with the extensive low area iii. then moving northeast toward the upper lake region. Its track has not been charted. Maximum velocities: Fort Canby, s., 44; Fort Assinniboine, sw., 28; Medicine Hat and Fort Garry, s., 30 miles.

V.—On the 8th this disturbance advanced southeast over the northwest territory and Manitoba. Light local rains fell on the 9th in the upper lake region, and the 10th partly as snow in the lower lake region, New England, and Saint Lawrence valley. High winds were occasionally reported: Milwaukee, nw., 32; Buffalo, w., 48; Father Point, ne., 30; Delaware Breakwater, w., 37; Block Island, nw., 31 miles. Cautionary signals were ordered, morning of the 10th, for Lakes Erie and Ontario and the New England coast, and off-shore signals in the afternoon for the New York, New Jersey, Delaware, and Virginia coasts; they were justified, excepting along the New England coast only partly so. High winds occurred night of the 9th and 10th along Lakes Michigan and Huron, for which signals had not been displayed.

VI.—This storm was first observed evening of the 9th as advancing southeast over the northwest territory, accompanied by high southerly winds. The 10th, it passed east over Manitoba; the 11th, southeast to northeastern New York, with brisk to high westerly winds and light local rains or snow, then quickly disappeared eastward. High winds: Grand Haven, w., 29; Buffalo, w., 42; Ottawa, se., 30; Delaware Breakwater, n., 32; Kitty Hawk, ne., 38 miles. At midnight of the 10th signals were displayed along the upper lakes; morning of the 11th, along the lower lakes, and afternoon, along the New England coast; off-shore along the New Jersey coast afternoon of the 11th. Excepting for the New England coast, they were fully justified.

VII.—High southerly winds and falling barometer heralded the approach of this storm on the 11th in the northwest territory and northern Montana. The 12th, it moved southeast toward Lake Superior, with increasing southwesterly winds in the lake region. In the Missouri and upper Mississippi valleys the temperature rose from 20° to 40° above the normal. During the 13th high winds were general in the lake region, and in connection with low area viii., threatening and rainy weather prevailed from the lakes to the Gulf. On the 14th it passed over the mouth of the Saint Lawrence, with rain from the eastern Gulf and Atlantic coasts to the lakes and Saint Lawrence valley, but partly as snow in the two last-mentioned sections; high winds were general throughout the lake region, Saint Lawrence valley, New England, and middle Atlantic states; lowest barometer at Father Point 29.16 inches, or .82 below the normal. It disappeared eastward on the 15th. Maximum velocities: Qu'Appelle, s., 30; Fort Assinniboine, sw., 30; Duluth, n., 36; Marquette, nw., 32; Milwaukee, n., 39; Sandusky, nw., 40; Rochester, nw., 35; Block Island, sw., 30, and nw., 44; Delaware Breakwater, nw., 46; Kitty Hawk, ne., 42; Mount Washington, nw., 88 miles. On the morning of the 12th signals were ordered up along Lakes Superior and Michigan, and in the afternoon along Lakes Huron, Erie, and Ontario, and warnings sent for the Canadian stations along the lakes and Saint Lawrence valley. Morning of the 13th signals were ordered for the New England coast, and in the afternoon off-shore for the New Jersey coast; midnight, warnings were sent for stations in the Canadian maritime provinces; morning of the 14th, signals for the Virginia and North Carolina coast. They were very generally justified.

VIII.—Falling barometer, increasing easterly winds, and threatening weather with light local rains on the Texas coast, on the morning of the 12th, indicated the presence of a disturbance off the coast. During the 12th and 13th it moved northeastward, accompanied by rainy weather in the Gulf states. On the latter date it lost its identity by being merged into the extensive low-pressure existing over the country from the Mississippi valley to the Atlantic coast, caused by low area vii., then moving eastward north of the lake region. High winds were reported from Indianola only, viz., e., 27 miles. Cautionary signals were ordered up on the morning of the 12th at Indianola and Galveston, but justified as to velocity at the former only.

IX.—As shown on the chart, the centre of this disturbance moved rapidly southeastward on the 15th from the northwest territory over Dakota, accompanied by light snows. During the 16th it was accompanied by generally light snow from Tennessee and the Missouri valley eastward to New England, with occasionally high winds; afternoon barometer at Indianapolis, 29.58 inches, or .54 below normal. The 17th, it traveled with extraordinary rapidity northeast along the coast; the central pressure continued decreasing, and at midnight the Sydney barometer fell to 29.09 inches, or .85 below the normal; heavy snow and northeasterly gales prevailed in its northern half. Maximum velocities: Fort Assinniboine, sw., 26; Yankton, n., 32; Ludington, ne., 30; Erie, n., 38; Cape Henry, nw., 40; Block Island, ne., 36; Eastport, n., 31; Father Point, ne., 35 miles. Signals were displayed on Lake Michigan morning of the 16th; afternoon, along the coast from North Carolina to Rhode Island; midnight, from Massachusetts to Maine. They were partly justified along Lake Michigan, New Jersey, and southern New England, and justified in the other sections.

X.—The night of the 16th this storm quickly passed southeastward from the northwest territory to Dakota. The 17th, the morning barometer at Bismarck read 29.40 inches, or .83 below the normal; snow fell from the Missouri valley to the lakes; high winds accompanied it, which at places in its western half increased to gales on account of the steep barometric gradient. On the 18th and 19th it disappeared to the northeastward, with high southwesterly winds along the middle Atlantic and New England coasts and the Saint Lawrence valley, and northwesterly in the lake region. Maximum velocities: Fort Assinniboine, sw., 36; Fort Custer, nw., 72; Cheyenne, nw., 40; Yankton, nw., 38; Duluth, w., 36; Milwaukee, nw., 33; Sandusky, w., 56; Buffalo, w., 40; Kitty Hawk, ne., 36; Delaware Breakwater, sw., 44; Eastport, s., 28; Mount Washington, nw., 70; Father Point, nw., 40; Ottawa, w., 35 miles. Cautionary signals were ordered, morning of the 17th, for Lake Michigan, and warnings sent at midnight for Canadian stations along the lakes and Saint Lawrence valley; morning of the 18th, from Virginia to southern New England, and continued from previous storm for remaining New England coast stations; midnight of the 18th, for North Carolina coast. All were fully justified.

XI.—During the progress of number x. on the 17th, a barometric trough formed, which extended southwestward to New Mexico and Texas. On the 18th a distinct depression developed in Texas and moved eastward, accompanied by light rains from the eastern Gulf coast to Tennessee. On the 19th it produced rain from the eastern Gulf coast to New Jersey, and snow from Arkansas northeast over the Ohio valley to New England; on the coast, between Cape Hatteras and Cape Cod, high northeasterly winds. Maximum velocities: Indianola, sw., 35 and ne., 36; Delaware Breakwater and Block Island, ne., 32; Sandy Hook, ne., 36 miles. Signals were ordered up at Indianola and Galveston on the morning of the 18th; also along the New England coast and New Jersey, and continued up, from the preceding low, along the North Carolina coast. They were only partly justified along the Texas and northern New England coast, but justified otherwise. The warnings sent out for the Canadian maritime stations, afternoon of the 19th, were not justified as to velocity, although heavy snow fell in Nova Scotia.

XII.—This disturbance appeared off the New Jersey coast, morning of the 21st. High northeast backing to northwest winds prevailed on the coast from New Jersey northeastward to Cape Cod, and in Nova Scotia, and snow fell in the middle Atlantic states, New England, and Canadian maritime provinces. Lowest barometer at Sydney, 29.38 inches, or .58 below normal. Maximum velocities: Sandy Hook, nw., 42: Block Island, nw., 46; Mount Washington, nw., 92 miles. Signals were not ordered for this storm.

XIII.—The centre of this low area moved east, to the north of the Signal Service stations, and could not be charted. Snow accompanied it in the lake region on the 20th and 21st, and high westerly winds on the latter date. Maximum velocities: Grand Haven, w., 29; Mackinaw City, nw., 32; Saugeen, sw., 42; Buffalo, w., 46; Rochester, w., 40 miles. No signals were ordered. Although the storm was not severe on Lake Michigan, yet it was sufficiently so to justify signals if they had been displayed.

XIV.—For several days previous to the 21st the pressure had been generally below the normal in the Pacific coast regions, with light local rains which on the 20th extended to Arizona. The 21st, rain was general from the Pacific coast to Utah and Arizona. The barometer reached its minimum at Portland, Oregon, 29.67 inches, or .37 below the normal, and next morning was .36 inch below the the normal at Salt Lake City. During the 22d it passed southeast over Utah and Colorado. Threatening weather with rain prevailed from Arizona and Utah to the Gulf states, Tennessee, and lower Ohio valley, but with snow and increasing easterly winds from the Missouri valley to the upper lake region; the central pressure continued diminishing. The 23d, morning barometer at Leavenworth, 29.74 inches, or .51 below normal. The rain-area reached the Atlantic coast, but mostly as snow in New England, middle Atlantic states, lake region, and upper Mississippi and Missouri valleys; in the lake region severe gales occurred. During the 24th a secondary depression developed on the middle Atlantic coast, but by midnight the two had reunited southeast of Maine. The 25th, a slight depression, which had been left in the Gulf states the 24th, passed northeast off the middle Atlantic and southern New England coast, followed by clearing weather. Maximum velocities: Indianola, s., 31; Milwaukee, se., 46; Mackinaw City, e., 41; Erie, se., 44; Rochester, s., 40; Sandy Hook, n., 37; Block Island, se., 36; Provincetown, se., 32 miles. Afternoon of the 22d, signals were ordered for Lake Michigan, and at midnight, from North Carolina to New York; afternoon of the 23d, along the New England coast. Warning was also sent for the Canadian lake stations on the 22d, and for those in the Saint Lawrence valley and maritime provinces on the 23d. All were well justified, excepting those in northern New England which were only partly justified.

XV. After the previous storm had left the north Pacific coast, the barometer continued below the normal in that region, with rainy weather. During the 24th the pressure diminished very rapidly; barometer at Olympia 29.49 inches, or .50 below normal; heavy rains and southerly gales prevailed in the middle and north Pacific coast regions, as the centre passed eastward over British Columbia. Its movement southeast was very rapid on the 25th, with light snows from the upper Missouri valley to upper Michigan; at Fort Assinniboine the barometer fell .73 inch below the normal. Two distinct depressions developed on the 26th and reunited later; snow prevailed from the Missouri valley to the upper lake region, with high winds and gales. During the 27th and 28th it developed great energy; at Chatham, New Brunswick, the barometer fell to 28.55 inches, or 1.42 below the normal; gales occurred from the lower lakes and middle Atlantic coast northeastward to the Gulf of Saint Lawrence; heavy rains fell in its southeastern half and heavy snow in its northwestern half. From New England north and eastward, it was the most severe storm of the month. Maximum velocities: Cape Mendocino, se., 60; Fort Canby, sw., 48; Portland, Oregon, s., 34; Spokane Falls, sw., 48; Fort Custer, w., 72; Cheyenne, nw., 36; Duluth, nw., 38; Grand Haven, s., 33; Indianola, n., 34; Macon and Hatteras, nw., 40; Rochester, nw., 40; Sandy Hook, nw., 56; Cape May, w., 61; Barnegat City, nw., 59; Block Island, nw., 55; Eastport, s., 30 and nw., 37; Yarmouth, Nova Scotia, w., 50; Father Point, ne., 60; Mount Washington, s., 74 and nw., 132 miles. Cautionary signals were ordered to be displayed on Lake Michigan on the afternoon of the 25th, and warning, sent for the Canadian lake stations at night. On the afternoon of the 26th off-shore signals were ordered for the Texas coast for a "norther," as high area viii. was rapidly extending southward toward the Gulf in the rear of this low. On the 27th signals were also hoisted along the coast from North Carolina to Maine, and at night, warnings sent, although late, for stations in the Canadian maritime provinces. The signals were fully justified.

XVI.—On the 26th the barometer again fell very suddenly in the north Pacific coast region, with rainy weather and high southerly winds; lowest barometer at Olympia, 29.38 inches, or .61 below the normal. During the 27th the storm-centre quickly crossed the northwest territory and Manitoba, accompanied by snow and gales thence south over Montana. Maximum velocities: Portland, Oregon, s., 28; Olympia, s., 28; Fort Assinniboine, sw., 48; Fort Custer, w., 36; Medicine Hat, s., 60; Minnedosa, nw., 40 miles.

XVII and XVIII.—After the previous low area had passed eastward the pressure was left considerably below the normal in the Rocky mountain region on the 27th. From that, low area xvii. developed over Idaho and Utah, and moved southeastward during the 28th to Kansas; barometer at Salt Lake City, .38 inch below normal. The 29th, low area xviii. began to form in the southern extremity of the barometric trough, over New Mexico and Texas; threatening weather with generally light rains prevailed from the western Gulf states to Missouri. The 30th and 31st they gradually disappeared, as shown on the chart, but at midnight of the latter date threatening weather with rain was general from the Gulf and Atlantic coasts to the Ohio valley, and with snow in New England, the lake region, and Missouri valley. High winds: Fort Stockton, se., 31; Indianola, n., 36 miles. Cautionary signals were ordered for Lake Michigan on the 29th, but only partly justified. Warning was sent, morning of the 30th, for the Canadian stations on Lakes Erie and Huron.

NORTH ATLANTIC STORMS DURING DECEMBER, 1883.

[*Pressure expressed in inches and in millimetres; wind-force by scale of* 0—10.]

Chart ii. exhibits the tracks of the principal atmospheric depressions that have moved over the north Atlantic ocean during December, 1883. The location of the various storm-centres has been approximately determined from reports of observations furnished by agents and captains of ocean steamships and sailing vessels in the north Atlantic, and from other miscellaneous data received at this office up to January 22d, 1884. The observations used are in general simultaneous, having been taken each day at 7 h. 0 m., a. m. Washington, or 0 h. 8 p. m., Greenwich, mean time.

Ten depressions have been sufficiently defined to admit of an approximation of their paths. Of these, numbers ii., viii., ix., and x. are probably continuations of storms which originated in the United States; of the remaining depressions, numbers i. and v. exhibited considerable storm-energy, the latter being especially severe along the coasts of Nova Scotia and Newfoundland. The eastward movement of the disturbances appears to have been somewhat checked by the presence of an area of high-pressures, which, during the greater part of the month, occupied the ocean from the European coasts westward to the forty-fifth meridian.

The following are descriptions of the depressions charted:

I.—This disturbance apparently developed south of the thirtieth parallel during the closing days of November. Numerous vessels between N. 25° and 30°, and W. 60° and 70°, reported strong gales during the 28th, 29th, and 30th. The following reports are given as indicating the severity of the storm on the

30th: the bark "Dunsinane," in N. 28° 30′, W. 67° 00′, had a heavy ne. to nw. and w. gale, lasting eight hours, during which she had decks swept, bulwarks stove, and split several sails; the brig "Wm. Mason," in N. 26° 24′, W. 70° 50′, encountered a heavy nw. gale, in which she lost and split sails; the brig "Elviva," in N. 29° 30′, W. 70° 00′, reported a hurricane from s. backing to se., ne., and n.; vessel lost several sails. On December 1st the disturbance was near Bermuda; on that date, the bark "Loreley" was dismasted in a hurricane off Bermuda; the bark "Sampo," in N. 34°, W. 64°, lost spars and had bulwarks damaged; the ship "Regina" was abandoned in N. 39°, W. 58°, the vessel having been rendered a total wreck by the fury of the gale. The only barometric observations recorded by vessels near the centre of disturbance on the 1st are those of the s. s. "Orinoco" and the bark "E. D. Bigelow." The former, in N. 35° 50′, W. 68° 20′, reported barometer 29.78 (756.4), wind nw., force 4, heavy cross sea from e; the "E. D. Bigelow," in N. 39° 29′, W. 63° 40′, reported barometer 29.62 (752.3), wind gusty and veering to se., then backing to nne., and blowing a hard gale with violent squalls. During the 1st the disturbance moved northeastward, and on the 2d it was central near the banks of Newfoundland, causing strong gales along the coasts. The s. s. "Devon," on the Banks, reported a heavy nw. gale, in which the barometer fell to 28.83 (732.3). Captain T. L. Weiss, commanding the s. s. "Llandaff City," reported: 2d, 7 h. 30 m., Greenwich time, wind ese., force 7, barometer 29.2 (741.7), rainy weather, sea rising; 11 h. 30 m., barometer 28.5 (723.9), wind se., force 7, fog and rain (ship's position, about N. 44° 48′, W. 51° 45′); 12 h. 30 m., wind shifted to sw., and gradually hauled to w., and decreased to force 6; 16 h. 30 m., barometer 29.0 (736.6), wind w., misty, wet weather. The s. s. "Lord Gough," E. M. Hughes, commanding, in N. 47° 16′, W. 50° 00′, on the 2d reported: noon (Greenwich mean time), barometer falling rapidly and wind increasing, weather threatening; 3.30 p. m., sudden shift of wind from ese. to sw., force 8, with heavy rain, barometer 28.82 (732.0); the barometer rose as rapidly as it had previously fallen and the weather moderated. On the 2d all vessels between N. 45° and 50° and near the fiftieth meridian reported strong easterly and southeasterly gales with rainy weather and high sea. By the 3d the depression appears to have filled up, the pressure being 30.0 (762.0) and above, over the ocean east of the fortieth meridian on that date.

II.—This was probably a continuation of the depression charted as low area i., chart i. On the morning of the 3d, the disturbance was off the coast of Nova Scotia, attended by strong northwesterly gales in the southwest quadrant, and moderate southerly and southwesterly gales to the eastward of the centre. Captain H. Schoonhoven, commanding the s. s. "Daniel Steinmann," reported: "December 3d, 8 a. m. (Greenwich time), a storm sprang up from wsw., barometer 29.38 (746.2); 1 p. m., wind wsw., force 9; 6 p. m., wind wnw., force 7, barometer 29.58 (751.3), snow and hail; 11 p. m., wind decreasing to force 6, sky clearing, (ship's position at noon, N. 42° 53′, W. 61° 33′)." On the 4th the region of least pressure was transferred to about N. 47°, W. 47°. On that date the s. s. "Schiedam," J. L. A. d'Harnecourt, commanding, reported: "N. 46° 04′, W. 48° 42′, during the night had fine se. wind with clear sky, but falling barometer; at 9.19 a. m., the wind suddenly, and without any previous signs, shifted to west and increased, accompanied by light rain, and lower temperature; the barometer, at the time of the shift of the wind, read 29.51 (749.5)." Captain Cochrane, commanding the s. s. "The Queen," in about N. 47° 21′, W. 44° 43′, reported as follows: "At noon, (Greenwich mean time) of the 4th, wind sw. dense fog, barometer 29.57 (751.3), the wind suddenly shifted to nw., and freshened to a fresh gale, clearing off the fog; the barometer then began to rise and the wind backed to w., with high w. and sw. sea, and snow squalls at intervals." Moderate to strong northwesterly gales continued over the region west of the fiftieth meridian as the pressure increased in rear of the depression. On the 5th the disturbance was near N. 50°, W. 39°, the pressure having increased to 29.7 (754.4); during the day the depression appears to have filled up, and by the following day it had disappeared, the atmospheric pressure over mid-ocean having become uniform.

III.—During the 5th a slight depression passed over the Gulf of Saint Lawrence, and on the morning of the 6th it was probably central near Cape Breton island. During the day it passed northeastward and was dissipated before reaching the thirty-fifth meridian, where an area of high-pressure prevailed. The following report is furnished by Captain S. R. Hill, commanding the s. s. "Surrey": December 7th, 15 h. Greenwich time, strong breeze and hard squalls from ssw., barometer 30.2 (767.1), wind increasing in force to a moderate gale, with hazy weather; 19 h., 30.1 (764.5); 20 h. 30 m., barometer 29.88 (758.9), wind suddenly shifted to wnw., the barometer then began to rise and at 23 h. it read 30.15 (765.8); the gale began to abate at 7 h. on the 8th, when the barometer read 30.46 (773.9). Ship's position at noon of the 7th, N. 48° 21′, W. 43° 32′.

IV.—The pressure, which for several days had been high over the British Isles and western Europe, began to give way during the 10th, and by the 11th a depression appeared to the northwestward of the British Isles. This disturbance was probably identical with the one which caused the destructive gale that occurred over the British Isles on the 11th and 12th. The structural damage was very great, shipping in the harbors and on the coasts suffered severely, and several persons were killed or injured.

V.—This disturbance appeared near the banks of Newfoundland on the 10th; it moved slowly north-northeastward and probably combined with low area v. of chart i., which had passed over the Canadian maritime provinces during the 11th. Captain W. H. Trant, commanding the s. s. "Venetian," reported: 10th, in N. 44° 23′, W. 56° 20′, barometer 29.72 (754.9), wind variable; during the twenty-four hours the wind veered twice around the compass by north and east, and settled to west at noon. On the 11th the wind and sea began to increase, with heavy rain and slight sea-swell from n., barometer falling. At 3 p. m. the barometer read 29.32 (744.7); 6 p. m., 29.07 (738.4); 8 p. m., 29.02 (737.1); midnight, 29.00 (736.6), at which time it was blowing a steadily increasing gale from sse. to ssw., with high cross sea and thick, misty weather. By morning of the 12th the storm-centre was probably near N. 50°, W. 48°; the pressure had decreased to 28.9 (734.0), and the winds in the eastern quadrants had attained the force of a violent gale. Captain Trant, of the s. s. "Venetian" reported, 2 a. m. of the 12th, barometer 28.9 (734.0), which was the lowest reading during the gale, wind sw., heavy gale, with high ssw. sea; 8 a. m., same weather, with violent squalls; noon, weather moderating, wind wsw. (ship's position from noon of 11th to noon of 12th, N. 45° 40′, W. 50° 30′, to N. 47° 30′, W. 45° 30′). The depression moved rapidly northeastward and on the 13th it was to the northward of the fifty-fifth parallel and near W. 27°. The lowest reported pressure was 29.61 (752.1), wind wsw., force 6, cloudy, observed in N. 54° 00′, W. 29° 38′, on board the s. s. "Sardinian," J. E. Dutton, commanding. The s. s. "Japanese," also encountered this storm on the 13th; that vessel reported a hurricane at 2 a. m. in N. 56° 46′, W. 24° 12′, with fearfully high seas, which washed completely over the vessel, destroying boats, bulwarks, and doing much damage to deck fittings. Strong northwesterly gales were reported by vessels on the fiftieth parallel and between W. 30° and 50°; the disturbance continued its northeasterly course, and by the 15th it was a deep depression, 29.2 (741.7), central north of Scotland.

VI.—This depression moved over Canada and the Gulf of Saint Lawrence on the 15th, and was central off the southern coast of Newfoundland on the 16th, causing strong breezes to moderate gales along the coasts. Its eastward movement appears to have been checked by an area of high-pressures which existed near the forty-fifth meridian.

VII.—By the morning of the 21st the pressure over the ocean

between W. 40° and 20° was about 29.8 (756.9), being a decrease of .5 inch during the preceding twenty-four hours. By the 22d the decrease had extended to the British Isles, and a well-defined centre of disturbance was north of Scotland.

VIII.—This was a continuation of low area xii. of chart i. On the 22d the disturbance was central off the eastern coast of Newfoundland, attended by moderate to strong southerly gales to the eastward of W. 50° and heavy northwesterly and westerly gales over the region west of that meridian. Captain Freeth, commanding the s. s. "British Princess," reported, in N. 47° 19′, W. 50° 6′, barometer 28.73 (729.7), wind w., force 9. Captain P. Urquhart, commanding the s. s. "Lord Clive," reported as follows: "22d, 4 a. m., ship's time, (7.41 a. m., Greenwich time), in N. 46° 35′, W. 55° 10′, barometer 29.11 (739.4), having fallen one inch in the previous eight hours, wind se., force 10, snow and rain; 6 a. m., (9.42 a. m., Greenwich time) position N. 56° 03′, W. 55° 25′, barometer 28.78 (731.0), wind nw., blowing a hurricane, with terrific squalls; the wind shifted suddenly from s. to wnw., nw., and nnw., the barometer at once beginning to rise. It blew for about one and a half hours at hurricane force, after which it began to moderate; at noon (3.45 p. m., Greenwich time) the barometer read 29.51 (749.5), wind wnw., force 8, with snow squalls and high cross sea." The s. s. "Helvetia," J. W. Rogers, commanding, furnishes the following:

Date.	Time.	Barometer.		Wind.		Remarks.
		Inches.	Mill.	Direction.	Force 0–10	
22.....	—— a. m...	.....	.....	sse.	.....	Wind hauling by west to south at 2 a.m.
22.....	3.48 a. m...	29.44	742.7	s. by w.	8	Squalls of force 9; heavy rain.
22.....	4.50 a. m...	29.08	737.9	s. by w.	.....	
22.....	5.51 a. m...	28.98	735 3	s. by w.	8	
22.....	6.52 a. m...	28.87	733.3	ssw.	.....	Squalls of force 9, and heavy rain.
22.....	7.10 a. m...	28.87	733-3	ssw.	7	
22.....	7.25 a. m...	28.89	733.8	wsw.	7	
22.....	7.53 a. m...	28.91	734-3	.....	.....	Clearing and moderating.
22.....	9.13 a. m...	.....	.....	wnw.	7	
22.....	9.53 a. m...	29.20	741.7	wnw.	.....	
22.....	12.08 p. m...	29.30	744.2	w. by n.	7	N. 43° 58′, W. 57° 42′.

On the 23d the region of least pressure was near N. 51°, W. 40°; the s. s. "State of Nebraska," A. E. Braes, commanding, reporting in N. 50° 23′, W. 37° 36′, barometer 29.25 (742.9), wind w. by s., force 8, hail squall. Moderate to fresh southerly and southwesterly gales were reported by vessels between the meridians of W. 35° and 20°. On the 24th the disturbance having apparently moved by a southeasterly course, was near N. 49°, W. 34°, where the barometer read 29.25 (742.9). During the 25th, 26th and 27th, the depression remained nearly stationary between N. 48° to 51°, and near the thirty-second meridian, the central pressure having increased to 29.6 (751.8) on the 26th, followed on the 27th by a slight decrease. By the 28th the depression had ceased to exist, having been replaced by an area of high-pressure which was spreading over the ocean.

IX.—This was probably a continuation of the disturbance charted as low area xiv. of chart i. It passed off the New England coast during the 24th, and was central east of Nova Scotia on the 25th. The s. s. "Abyssinia," in N. 41° 06′, W. 66° 56′, had a moderate se. to sw. gale with snow squalls; and the s. s. "Mareca," in N. 41° 30′, W. 60° 00′, reported a heavy gale with very high sea. The depression moved east-northeastward to about N. 46°, W. 42°, where the pressure ranged from 29.5 (749.3) to 29.7 (754.4). It continued its northeastward course during the 26th, and united with depression number viii. on the 27th; the lowest barometer reading on that date was reported by the s. s. "Oregon," H. C. Williams, commanding, 29.48 (748.8), wind variable, force 1, drizzling rain, followed by a moderate gale from nnw.

X.—This was a continuation of low area xv. of chart i., and was probably the most severe storm of the month. It was attended by very heavy northwesterly gales along the Atlantic coast north of Hatteras, and caused much damage to shipping. It passed over Canada and the Gulf of Saint Lawrence during the 28th, the pressure near the centre, when over the Gulf, being below 29.00 (736.6). The following reports indicate the severity of the gale after reaching the ocean:

Captain Malet, commanding the s. s. "Marengo," reported: "27th, midnight, wind hauling to s., barometer 29.22 (742.2); 2 a. m. of 28th, calm, barometer 29.02 (737.1); 2.30 a. m., wind freshening from westward, force 7, with heavy rain; 4 a. m., fresh gale of force 7, high w. by s. sea; 7.15 a. m., wind shifted to wnw., strong gale of force 9; 8 a. m., heavy w. gale of force 10, barometer 29.12 (739.6), rising." (Ship's position about N. 41° 10′, W. 68° 20.′)

Captain Perry, commanding the s. s. "Britannic" reported: "December 27th, at noon in latitude 44° N, longitude 56° 26′ W., light breeze from sse., fine weather, barometer 30.35 (770.9), temperature of the air 38°, water, 40°. At midnight the barometer read 29.96, (761.0); at 6.30 a. m. of the 28th, sudden squall of hurricane force, lasting five minutes, rain at intervals, wind increasing and backing from ssw. to sse.; at 8 a. m. the wind hauled to sw. and increased; at 8.30 another terrific squall with rain set in; at 10 a. m., barometer 29.2 (741.7), heavy gale and high sea with terrific squalls; noon, barometer 29.27 (743.4), rising, wind w.; 3 p. m., wind wnw., fierce gale. The same weather continued, with rising barometer, until midnight, when it began to moderate. At noon of the 29th, in N. 40° 40′, W. 67° 00′, barometer read 29.65 (753.1), wind nw., moderating."

The s. s. "Lake Manitoba," Wm. Stewart, commanding, reported: "4 p. m. of the 28th, barometer 30.05 (763.3), fresh sse. wind with rain; 7 p. m., barometer 29.81 (757.2), strong s. by e. gale, heavy cross sea from wsw. and sse., constant rain. At 4 a. m. 29th, barometer 29.26 (743.2), moderate sw. gale, very heavy sea; same weather continued until midnight, when the barometer read 29.36 (745.7), rising rapidly, fresh wnw. gale." (Ship's position, N. 45° 0′, W. 53° 24′ to W. 57° 30′).

Captain C. Steencken, commanding the s. s. "Habsburg," furnishes the following report of observations made during the gale:

Date.	Hour.	Barometer.		Wind.		Remarks.
		Inch.	Mill.	Direction.	Force 0–10	
28.....	4 a. m.....	29.58	751.3	s.	.....	Increasing wind and sea.
28.....	8 a. m..	29.14	740. 1	s.	7–9	N. 42° 25′, W. 61° 33′.
28.....	Noon.....	29.18	741.2	.....	.....	High w. sea.
28.....	4 p. m	29.16	740.7	wsw.	9–10	Increasing wind and sea.
28.....	8 p. m.....	29.20	741.7	wsw.	10	Squally; heavy sea.
28.....	Midnight...	29.35	745.5	w.	10	Hurricane.
29	4 a. m.....	29.42	747.3	.....	.....	
29 ...	8 a m.....	29.56	750.8	wnw.	9	Decreasing; ship's position, N. 41° 39′, W. 63° 52′.
29.....	Noon...	29.78	756.4	nw.	9	

Captain Robinson, commanding the s. s. "Canada," reported: "28th, 3 h., N. 46° 00′, W. 46° 12′, weather clear, barometer 30.28 (769.1), falling rapidly; at 11 h. it was blowing a gale of force 9, with ugly, threatening appearance and heavy, breaking sea; at 17 h., heavy rain with lightning in the wsw., wind s, force 7; at 23 h., barometer 29.32 (744.6), wind ssw., force 6. On the 29th at 3 h., the wind suddenly shifted to wnw., force 7, barometer slowly rising."

Captain McMickan, commanding the s. s. "Gallia," also reported strong sw., w., and nw. gales, with very high sea and much thunder and lightning during the 29th and 30th, vessel between N. 43° 09′, W. 53° 42′, and N. 42° 09′, W. 58° 13′. On the 30th the storm-centre was probably near N. 51° W. 44°, the s. s. "Switzerland," W. A. Beynon, commanding, reported barometer 29.45 (748.0), wind w. by n. force 4, having shifted from s. by e., force 8. On the 31st the depression appeared to be filling up, the lowest reported pressures over mid-ocean ranging from 29.65 (753.1) to 29.8 (756.9).

TEMPERATURE OF THE AIR.

[*Expressed in degrees, Fahrenheit.*]

The distribution of mean temperature over the United States

and Canada for the month of December, 1883, is exhibited on chart iii. by the dotted isothermal lines.

The general distribution of mean temperature, and the districts of maximum departures from the normal, for the month of December in each year, from 1872 to 1882, inclusive, are as follows:

Districts.	Maximum departures.	Year.	Distribution.
	°		
		1872...	Much below the normal everywhere east of the Rocky mountains, the departures at the various stations ranging from 5° to more than 8°.
Upper lakes	+ 8.0	1873...	Normal in the Gulf states; above the normal in all other districts east of the Rocky mountains.
Lower lakes	+ 7.0		
Middle Atlantic states	+ 5.0		
Ohio valley and Tennessee	+ 5.0		
Lower Missouri valley	+ 5.2	1874...	Below the normal in the Saint Lawrence valley; above the normal on the Pacific coast and in all districts east of the Rocky mountains, except in the Saint Lawrence valley.
Upper Mississippi valley	+ 4.1		
Ohio valley and Tennessee	+ 3.9		
Gulf states	+ 3.8		
Saint Lawrence valley	— 4.7		
Lower Missouri valley	+10.9	1875...	Above the normal over the whole country, except slightly below in the Saint Lawrence valley.
Upper Mississippi valley	+10.2		
Ohio valley and Tennessee	+ 9.0		
Minnesota	+ 9.0		
Saint Lawrence valley	— 0.5		
Upper Mississippi valley	— 8.7	1876...	Above the normal on the Pacific coast; below the normal in all districts east of the Rocky mountains, the departures ranging from 5°.2 to 8°.7.
Lower lakes	— 8.7		
Ohio valley and Tennessee	— 8.0		
South Atlantic states	— 7.9		
Pacific coast	+ 2.5		
Minnesota	+20.2	1877...	Above the normal over the whole country, the departures being least at the Rocky mountain stations, on the Pacific coast, and in the Gulf states.
Upper Mississippi valley	+17.1		
Lower Missouri valley	+15.3		
Upper lakes	+14.7		
Ohio valley	+11.4		
New England	+ 3.5	1878...	Normal in the middle Atlantic states; above the normal in New England, the Saint Lawrence valley, and upper lake region; below the normal in all other districts, the departures being small in the south Atlantic states, lower lake region, and on the Pacific coast.
Saint Lawrence valley	+ 1.9		
Missouri valley	— 4.4		
Tennessee and the Ohio valley	— 4.2		
Minnesota	— 4.0		
South Atlantic states	+ 8.6	1879...	Below the normal in the Saint Lawrence valley, upper lake region, on the Pacific coast, and over the regions between the Rocky mountains and Mississippi river north of the thirty-seventh parallel; above the normal in the southern slope, Gulf states, and in the districts on the Atlantic coast.
Florida peninsula	+ 5.8		
Middle Atlantic states	+ 5.7		
Eastern Gulf states	+ 5.5		
Minnesota	—18.5		
Lower Missouri valley	—12.4		
Northern slope	— 4.6		
Salt Lake City, Utah	+ 4.4	1880...	Above the normal west of the Rocky mountains, except normal over the northern plateau; below the normal in all districts east of the Rocky mountains, the departures ranging from 1°.7 to 6°.9.
Middle Pacific coast	+ 3.0		
Missouri valley	— 6.9		
Ohio valley and Tennessee	— 6.0		
Upper Mississippi valley	— 5.8		
Middle Atlantic states	— 5.4		
Lower Missouri valley	+13.1	1881...	Normal in southern California; below the normal on the middle Pacific coast; above the normal in all other districts, the departures being least in the Rio Grande valley and in the northern and southern plateau districts.
Northern slope	+12.1		
Minnesota	+11.2		
Upper Mississippi valley	+10.4		
Lake region	+ 9.1		
Middle Pacific coast	— 1.2		
Denver, Colorado	+ 5.8	1882...	Normal in the upper lake region and Missouri valley; above the normal over the northern and middle slopes and west of the Rocky mountains; below the normal in all other districts, the departures in the west Gulf states being less than 1°.
Middle plateau	+ 4.4		
Northern slope	+ 3.8		
Eastern Gulf states	— 3.6		
Tennessee	— 3.1		
South Atlantic states	— 3.0		

For the northern and middle Pacific coast regions, northern plateau, extreme northwest, upper lake region, and New England, the mean temperature is below the normal. For the upper lake region and northern plateau the departures are less than 1°; in the other districts named they range from 1°, in New England, to 2°.2, on the middle Pacific coast. For all other portions of the country the mean temperature of the month is higher than the average for December. For the south Atlantic and Gulf states, northern and middle slopes, Missouri valley, and Tennessee, the departures above the normal temperatures vary from 3°.4 in Tennessee to 4°.4 in the northern slope. For the upper Mississippi and Ohio valleys, middle Atlantic states, and from western Texas to southern California, the departures range from 2°.3 to 2°.7. For the summits of Mount Washington, New Hampshire, and Pike's Peak, Colorado, the monthly means are 0°.3 and 2°.2 above the normal, respectively.

In the following table are shown the normal temperatures for the month of December, the mean temperatures for December, 1883, and the departures from the normal in the several districts, as deduced from the observations made by the Signal Service observers.

Average temperatures for December, 1883.

Districts.	Average for December, Signal-Service observations.		Comparison of Dec., 1883, with the average for several years.
	For several years.	For 1883.	
	°	°	°
New England	31.0	30.0	1.0 below.
Middle Atlantic states	36.5	38.9	2.4 above.
South Atlantic states	48.1	52.2	4.1 above.
Florida peninsula	63.2	66.0	2.8 above.
Eastern Gulf states	49.9	53.8	3.9 above.
Western Gulf states	50.4	54.4	4.0 above.
Rio Grande valley	60.1	61.6	1.6 above.
Tennessee	42.2	45.6	3.4 above.
Ohio valley	35.7	38.2	2.5 above.
Lower lakes	28.8	30.2	1.4 above.
Upper lakes	24.1	23.9	0.2 below.
Extreme northwest	11.4	9.4	2.0 below.
Upper Mississippi valley	28.1	30.7	2.6 above.
Missouri valley	23.3	26.8	3.5 above.
Northern slope	23.1	27.5	4.4 above.
Middle slope	31.9	35.4	3.5 above.
Southern slope	45.8	48.1	2.3 above.
Southern plateau	43.2	45.9	2.7 above.
Northern plateau	34.2	33.6	0.6 below.
North Pacific coast	41.6	40.5	1.1 below.
Middle Pacific coast	48.5	46.3	2.2 below.
South Pacific coast	54.6	56.9	2.3 above.
Mount Washington, N. H	8.8	9.1	0.3 above.
Pike's Peak, Colo	5.9	8.1	2.2 above.
Salt Lake City, Utah	31.1	32.9	1.8 above.

The following are some of the highest and lowest monthly mean temperatures reported from the Signal Service stations:

Stations reporting highest.		Stations reporting lowest.	
	°		°
Key West, Florida	71.5	Saint Vincent, Minnesota	1.1
Sanford, Florida	62.5	Moorhead, Minnesota	5.9
Brownsville, Texas	61.9	Pike's Peak, Colorado	8.1
Rio Grande City, Texas	61.2	Mount Washington, New Hampshire	9.1
Jacksonville, Florida	60.5	Fort Buford, Dakota	9.9
New Orleans, Louisiana	60.3	Bismarck, Dakota	14.3
Galveston, Texas	60.2	Duluth, Minnesota	15.7
Indianola, Texas	59.5	Huron, Dakota	18.3
Pensacola, Florida	57.9	Fort Lincoln, Dakota	18.4
San Diego, California	57.5	Fort Bennett, Dakota	19.6

DEVIATIONS FROM MEAN TEMPERATURE.

The departures exhibited by the reports from the regular Signal Service stations are shown in the table of average temperatures for December, 1883. The following notes in connection with this subject have been reported by voluntary observers:

Illinois.—Anna, Union county: mean temperature, 39°.7, is 4°.6 above the December average of the last eight years.

Riley, McHenry county: mean temperature, 23°.2, is 1°.7 above the December average of twenty-two years. The mean temperature of the year 1883, (42°.4), is 2°.6 below the normal of a period of twenty years.

Mattoon, Coles county: mean temperature, 33°.3, is about the December normal for the last four years. The mean temperature for the year 1883, (51°), is 2°.4 below the normal of the same period.

Indiana.—Wabash, Wabash county: mean temperature, 32°.6, is 3°.4 above the December mean of the last eight years. The mean temperature of the year 1883, (49°2), is 2°.2 below the normal for seven years.

Logansport, Cass county: mean temperature, 30°.5, is 2°.6 above the December average of the last twenty-four years. The highest December mean of that period, 45°.0, occurred in 1877; the lowest, 14°.0, occurred in 1872.

Kansas.—Independence, Montgomery county: mean temperature, 37°.6, is 3°. above the December average of the last twelve years.

Wellington, Sumner county: mean temperature, 34°.4, is 3°.6 above the December average of the four preceding years.

Lawrence, Douglas county: mean temperature, 33°.7, is 4°.1

above the December average of the last sixteen years. Mean temperature of the year 1883. (51°.7), is 1°.9 below the normal of a period of fifteen years.

Maine.—Gardiner, Kennebec county: mean temperature, 22°.95, is 0°.68 above the December average of a period of forty-eight years. Mean temperature of the year 1883, (42°.01), is 1°.74 below the annual normal.

Maryland.—Fallston, Harford county: mean temperature, 33°.8, is 0°.8 above the December average of thirteen years.

Massachusetts.—Somerset, Bristol county: mean temperature for the year 1883, (48°.57), is 0°.9 below the annual normal for a period of ten years.

Worcester, Worcester county: mean temperature, 25°.95, is 2°.35 below the December average of a period of forty-four years. The lowest mean temperature for December of that period, 21.°3, occurred in 1876; the highest, 35.°4, occurred in 1847.

Missouri.—Saint Louis: mean temperature, 36°.8, is 3°.4 above the December normal of the last forty-six years.

New Jersey.—South Orange, Essex county: mean temperature, 31°.5, is 2°.5 above the December average of the last fourteen years.

New York.—North Volney, Oswego county: mean temperature, 26°.21, is 0°.7 above the average of the last fifteen years. The mean temperature of the year 1883, 43°.34, is 1°.85 below the normal of fifteen years, and is the lowest annual mean of that period with the exception, 41°.61 for 1875.

Palermo, Oswego county: mean temperature, 23°.6, is 0°.8 below the December average of the last thirty years.

The following table shows the monthly and annual mean temperatures at Wauseon, Fulton county, Ohio, with the dates of the first and last frosts in each year since 1870. From this table it will be seen that the mean temperature for December, 1883, is 28°.4, or 1°.7 above the December normal; and that the annual mean is 45°.4, or 2°.5 below the annual average.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual means.	Date of last frost.	Date of first frost.
	°	°	°	°	°	°	°	°	°	°	°	°	°		
1870	27.9	27.7	32.6	50.2	62.3	70.0	74.7	63.0	66.4	53.1	39.4	25.1	49.4	April 30	Aug. 27
1871	25.9	27.1	40.9	50.4	60.2	68.4	70.9	72.5	58.7	53.0	32.5	21.9	48.5	May 18	Sept. 21
1872	21.0	22.5	27.8	49.3	59.0	70.0	74.8	72.8	64.2	49.6	30.5	17.1	46.5	May 14	Sept. 20
1873	16.6	22.1	30.7	44.4	58.5	72.4	72.2	71.4	61.1	47.0	31.6	30.8	46.6	June 1	Sept. 14
1874	31.9	27.5	34.2	38.6	60.3	71.4	73.5	70.1	64.8	50.9	28.9	28.2	48.4	June 13	Sept. 21
1875	12.2	11.3	29.5	41.5	57.5	67.7	71.5	66.3	59.1	46.0	33.2	34.5	44.2	May 17	Sept. 18
1876	32.3	31.0	29.9	44.4	59.0	70.0	74.9	72.5	60.2	46.5	38.1	17.9	48.1	May 24	Sept. 27
1877	30.0	33.4	26.5	47.2	57.7	68.7	72.3	71.0	64.4	55.6	37.7	38.8	49.4	June 23	Sept. 19
1878	28.2	29.5	43.2	54.8	56.8	67.2	75.3	71.5	64.3	50.8	39.4	22.6	50.3	May 15	Sept. 27
1879	21.3	24.5	35.7	47.3	59.1	67.1	74.9	69.3	57.9	59.0	38.3	29.6	48.7	May 22	Sept. 10
1880	37.7	31.7	31.1	47.7	64.3	67.1	70.5	70.0	64.2	51.5	27.9	20.7	48.7	May 14	Sept. 14
1881	10.4	21.9	30.9	41.2	63.8	65.5	73.1	72.1	71.1	54.8	39.0	34.9	48.7	May 3	Sept. 12
1882	25.9	35.4	37.8	44.6	52.2	66.0	67.7	70 6	62.6	52.9	37.7	24.0	48.1	June 6	Oct. 15
1883	18.7	23.6	28.0	45.4	52.7	66.5	70.0	65.5	57.2	48.7	40.3	28.4	45.4	June 1	Sept. 9
Average	24.6	26.4	32.8	46.2	58.8	68.4	72.6	69.9	62.6	51.4	35.3	26.7	47.9	May 23	Sept. 18

NOTE.—Previous to October, 1883, the means were computed from observations made at 5 a. m. and 1 and 9 p. m.; formula, $\frac{1}{3}$ (5 + 1 + 9). Subsequently the observations were made at 7 a. m. and 2 and 9 p. m.; formula, $\frac{1}{4}$ (7 + 2 + 9 + 9).

Pennsylvania.—Dyberry, Wayne county: mean temperature, 26°.5, is 1°.5 above the December average of the last nineteen years.

Texas.—New Ulm, Austin county: mean temperature, 55°.2,

Table of Comparative Minimum Temperatures for the Month of December.

State or Territory.	Minimum for December, 1883, Signal Service.		Minimum since Signal-Service stations were opened—3 to 12 years.			Lowest from any other source.			
	Station.	Temp.	Station.	Temp.	Year.	Place.	Temp.	Year.	Length of Record.
		°		°			°		
Alabama	Montgomery	27	Montgomery	8	1880	Huntsville	— 7		9 years.
Do	Mobile	28	Mobile	14	1880	Thomas Barracks	10	1875	2 "
Arizona	Willcox	10	Prescott	—18	1879	Fort Canby	—25	1855	12 "
Arkansas	Fort Smith	20	Little Rock	0	1880	Washington, near	— 6	1845	27 "
California	Sacramento	24	Campo	7	1878	Fort Jones	—17	'55, '57	5 "
Colorado	Pike's Peak	—32	Pike's Peak	—37	1878	Fort Garland	—30		39 "
Do	West Las Animas	—2.5	Denver	—25	1870	Fort Lyon	—30	1876	20 "
Connecticut	New London	— 7.5	New Haven	— 4	1880	Middletown	—18	1860	11 "
Do	New Haven	— 6	New London	— 1	'75, '80	New Haven	—11		87 "
Dakota	Fort Buford	—34	Pembina	—59	1879	Fort Stevenson	—54	1879	7 "
Do	Fort Yates	—31	Forts Buford and Stevenson	—46	1879	Fort Totten	—51	1879	7 "
Delaware	Delaware Breakwater	19	Delaware Breakwater	1	1880	Fort Delaware	9		44 "
District of Columbia	Washington	15	Washington	—13	1880	Washington	—10		48 "
Florida	Pensacola	29	Pensacola	17	1880	Fort Barrancas	15		52 "
Georgia	Atlanta	22	Athanta	1	1880	McPherson Barracks	— 1	1880	7 "
Idaho	Lewiston	6	Lewiston	—16	1879	Fort Hall	—30	1879	10 "
Illinois	Chicago	0.5	Chicago	—15	1880	Rock Island Arsenal	—26		14 "
Indiana	Indianapolis	9	Indianapolis	—15	1876	Wabash	—19	1880	6 "
Indian Territory			Fort Gibson	— 9	1876	Fort Sill	—11		10 "
Iowa	Des Moines	—10	Dubuque	—19	'76 '79 '80	Cresco	—35	1879	8 "
Kansas	Dodge City	2	Dodge City	—15	1876	Fort Wallace	—24	1870	8 "
Kentucky	Louisville	15	Louisville	— 7	1880	Newport Barracks	— 8		28 "
Louisiana	New Orleans	37	Shreveport	10	1880	Okaloosks	10	1880	3 "
Maine	Eastport	—17	Eastport	—20	1875	Gardiner	—24		45 "
Maryland	Baltimore	17	Baltimore	— 3	1880	Emmittsburg	—19	1880	7 "
Massachusetts	Boston	—12	Boston	—11	1875	Billerica	—20	1876	8 "
Do	Provincetown	— 0.4	Springfield	—10	1875	Lunenburg	—16		24 "
Michigan	Marquette	—12	Escanaba	—23	1880	Fort Brady	—41		58 "
Minnesota	Saint Vincent	—40	Saint Vincent	—42	1880	Fort Ripley	—40		14 "
Do	Moorhead	—34.0	Breckenridge	—40	1879	Fort Snelling	—34		62 "
Mississippi	Vicksburg	30	Vicksburg	12	1880	Fayette	11	1880	8 "
Missouri	Saint Louis	8	Saint Louis	—15	1880	Rollo, near	—23	1870	7 "
Montana	Fort Assinniboine	—17	Fort Benton	—59	1880	Camp Baker	—53	1871	9 "
Nebraska	North Platte	— 5.5	North Platte	—27	1879	Sydney Barracks	—37	1879	5 "
Do	Omaha	— 9	Omaha	—17	1879	Glendale	—30	1868	2 "
Nevada			Winnemucca	—20	1879	Fort Halleck	—22	1879	12 "
New Hampshire	Mount Washington	—41	Mount Washington	—47	1870	Dartmouth College	—29		18 "
New Jersey	Sandy Hook	5.5	Barnegat and Sandy Hook	— 7	1880	Linden	—18	1880	6 "
New Mexico			Santa Fé	—13	1879	Fort Union	—28	1855	30 "
New York	Albany	— 8.5	Albany	—17	1875	Madison Barracks	—44	1871	54 "
North Carolina	New River Inlet	20	Charlotte	— 5	1880	Lenoir	—16	1880	8 "
Ohio	Toledo	10	Sandusky	—13	1880	Kenton	—20	1876	3 "
Do	Cleveland	11	Cleveland and Columbus	—12	1880	College Hill	—12	1880	65 "
Oregon	Fort Klamath	— 2	Umatilla	—22	1879	Eola	— 8	1879	7 "
Pennsylvania	Philadelphia and Erie	10	Erie	—11	1880	Lewisburg	—23	'65, '67	6 "
Rhode Island	Narragansett Pier	— 9	Newport	— 3	1875	Providence	—12		36 "
South Carolina	Charleston	29	Charleston	13	1880	Aiken	3	1880	7 "
Do						Charleston	20		104 "
Tennessee	Nashville	20	Knoxville	— 5	1880	Clarksville	— 4	1880	8 "
Texas	Fort Elliott	6	Fort Elliott	—10	1879	Camp Stockton	— 9	1859	15 "
Utah	Salt Lake City	5	Salt Lake City	—10	1879	Fort Crittenden	—22	1859	3 "
Vermont			Burlington	—19	1879	Lunenburg	—30	1868	20 "
Virginia	Fort Myer	15	Fort Myer	—11	1880	Alexandria	12		11 "
Washington Territory	Dayton	— 7.5	Olympia	—17	1879	Fort Colville	—22		21 "
West Virginia			Morgantown	— 9	1880	Flemington	—21	1880	2 "
Wisconsin	La Crosse	—10	La Crosse	—20	1879	Fort Howard	—38		31 "
Wyoming	Cheyenne	—11	Cheyenne	—24	'79, '80	Fort Fetterman	—36		14 "

Table of Maximum and Minimum Temperatures for December, 1883.

State or Territory.	Signal Service.			U. S. Army Post Surgeons, or Voluntary Observers.		
	Station.	Max.	Min.	Station.	Max.	Min.
		°	°		°	°
Alabama	Mobile	74	28	Auburn	70	20
Do	Montgomery	72	27	Mt. Vernon Bar'ks.	76	23
Arizona	Phœnix	87	20	Fort Lowell	76	28
Do	Willcox	80	10			
Arkansas	Fort Smith	78	20	Lead Hill	82	16
Do	Little Rock	74	28	Fayetteville	71	12
California	Los Angeles	80	37	Turlock	91	24
Do	Sacramento	67	24	Summit	40	— 6
Colorado	West Las Animas	68	— 2.5	Fort Lewis	58	—14
Do	Pike's Peak	28	—32	Pueblo	72	0
Connecticut	New London	56	— 7.5	Southington	52	—20
Do	New Haven	52	— 6	Voluntown	60	—13
Dakota	Fort Yates	62	—31	Fort Meade	69	—11
Do	Fort Buford	46	—34	Fort Pembina	45	—35
Delaware	Del. Breakwater	61	19			
District of Columbia	Washington City	60	15	Receiving Reservoir.	62	18
Florida	Key West	81	57	Limona	84	31
Do	Pensacola	74	29	Archer	80	23
Georgia	Atlanta	65	22	Andersonville	77	21
Do	Augusta	73	28	Forsyth	76	24
Idaho	Lewiston	54	6	Fort Lapwai	55	2
Do	Cœur d'Alene	50	18			
Illinois	Cairo	71	14	Mattoon	70	0
Do	Chicago	57	0.5	Polo	54	—12
Indiana	Indianapolis	62	9	Rising Sun	70	10
Do				Lafayette	60	— 3
Indian Territory				Fort Reno	77	15
Iowa	Keokuk	62	2	Muscatine	60	—11
Do	Des Moines	57	—10	Cresco & Guttenberg	50	—24
Kansas	Dodge City	67	2	Clay Centre	74	3
Do	Leavenworth	65	4	Holton	62	— 4
Kentucky	Louisville	68	15	Bowling Green	69	21
Do				Frankfort	65	10
Louisiana	New Orleans	76	37	Grand Coteau	77	30
Maine	Portland	52	— 8	Fort Preble	50	— 6
Do	Eastport	47	—17	Orono	48	—20
Maryland	Baltimore	60	17	Woodstock	68	10
Do	Ocean City	55	20	Emmittsburg	60	5
Massachusetts	Boston	58	—12	Somerset	58	—20
Do	Provincetown	50	— 0.4	Heath	50	—24
Michigan	Detroit	58	11	Kalamazoo	59	7
Do	Marquette	53	—12	Fort Brady	44	—16
Minnesota	Moorhead	55	—34	Fort Snelling	50	—24
Do	Saint Vincent	42	—40	Northfield	57	—19
Mississippi	Vicksburg	77	30			
Missouri	Saint Louis	72	8	Greenfield	78	10
Do				Oregon	63	— 5
Montana	Fort Benton	60	—10	Fort Keogh	54	—30
Do	Fort Assinniboine	51	—17	Fort Ellis	55	—18
Nebraska	North Platte	59	— 5.5	Fort Niobrara	62	—14
Do	Omaha	58	— 9	Fort Robinson	60	—11
Nevada				Halleck	42	—41
Do				Golconda	68	— 7
New Hampshire	Mount Washington	37	—41	Contoocookville	56	—17
Do				Grafton	46	—18
New Jersey	Atlantic City	58	11	South Orange	54	— 1
Do	Sandy Hook	57	5.5	Vineland	62	10
New Mexico				Fort Union	69	2
New York	Oswego	58	— 6	Flushing	59	1
Do	Albany	55	— 8.5	Johnstown	50	—30.5
North Carolina	New River Inlet	71	20	Chapel Hill	71	20
Do	Wilmington	72	27	Highlands	59	5
Ohio	Cincinnati	64	19	Canal Dover	70	8
Do	Toledo	58	10	Wauseon	56	— 5.5
Oregon	Roseburg	57	25	Eola	52	24
Do	Fort Klamath	49	— 2	Fort Klamath	52	0
Pennsylvania	Philadelphia	57	10	State College	60	3
Do	Erie	57	10	Dyberry	53	— 8
Rhode Island	Block Island	58	— 1			
Do	Narragansett Pier	56	— 9			
South Carolina	Charleston	75	29	Stateburg	72	25
Do				Aiken	70	23
Tennessee	Memphis	72	22	Austin	68	19
Do	Nashville	70	20	Ashwood	66	18
Texas	Rio Grande City	81	37	Austin	79	37
Do	Fort Elliott	72	0	Fort Concho	80	0?
Utah	Salt Lake City	50	5	Nephi	51	— 3
Do				Promontory	50	—10
Vermont				Dorset	57	—21
Do				Woodstock	47	—32
Virginia	Cape Henry	69	21	Variety Mills	64	18
Do	Fort Myer	62	15	Marion	58	16
Washington Territory	Dayton	56	— 7.5	Fort Townsend	60	19
Do	Olympia	56	24	Fort Spokane	52	—12
West Virginia				Helvetia	64	9
Wisconsin	Milwaukee	56	— 7	Beloit	54	— 9.5
Do	La Crosse	53	—10	Embarrass	52	—20
Wyoming	Cheyenne	60	—11	Fort Bridger	46	— 7

is 1°.2 above the December average of the last twelve years. The highest December mean of that period, 60°.9, occurred in 1875; the lowest, 46°.1, occurred in 1876.

Virginia.—Variety Mills, Nelson county: mean temperature, 38°.3, is 1°.8 above the December average of the last seven years.

Wytheville, Wythe county: mean temperature, 35°, is 3° above the December average of a period of nineteen years.

West Virginia.—Helvetia, Randolph county: mean temperature, 36°.4, is 3°.6 above the December average of the last seven years. The mean temperature for the year 1883 is 51°.8, or 1°.2 above the annual average of the same period.

MONTHLY RANGES OF TEMPERATURE.

The monthly ranges of temperature for December, 1883, were greatest in the upper Missouri and Red river of the North valleys, Wyoming, and eastern Colorado, where they varied from 70° to 93°. They were least on the northern and middle Pacific coasts and in southern Florida, the smallest range, 22°, occurring at San Francisco, California. The following stations report monthly ranges of 65° or more: Fort Yates, Dakota, 93°; Moorhead, Minnesota, 89°; Saint Vincent, Minnesota, 82°; Fort Buford, Dakota, 80°; Mount Washington, New Hampshire, and Bismarck, Dakota, 78°; Huron, Dakota, 77°; Fort Bennett, Dakota, 75°; Duluth, Minnesota, 73°; Yankton, Dakota, 72°; Fort Custer, Montana, and Cheyenne, Wyoming, 71°; Fort Benton, Montana, West Las Animas, Colorado, Willcox, Arizona, and Boston, Massachusetts, 70°; Saint Paul, Minnesota, 69°; Forts Assinniboine and Shaw, Montana, 68°; Phœnix, Arizona, and Omaha, Nebraska, 67°; Fort Elliott, Texas, 66°; Dodge City, Kansas, and Narragansett Pier, Rhode Island, 65°.

Stations reporting monthly ranges of 40° or less, are as follows: Prescott, Arizona, 40°; New Orleans, Louisana, 39°; Fort Macon and Hatteras, North Carolina, 38°; Ocean City, Maryland, 35°; Galveston, Texas, 34°; Cœur d'Alene, Idaho, Portland, Oregon, and Olympia, Washington Territory, 32°; Cape Mendocino, California, 31°; Roseburg, Oregon, 29°; Fort Canby, Washington Territory, 25°; Key West, Florida, 24°; San Francisco, California, 22°.

GREATEST DAILY RANGES OF TEMPERATURE.

The greatest daily ranges of temperature varied in the several districts as follows:

New England.—From 33° at New London, Connecticut, on the 15th, to 42° at Eastport, Maine, on the 15th, and 57° on the summit of Mount Washington, New Hampshire, on the 28th.

Middle Atlantic states.—From 21° at Delaware Breakwater, Delaware, on the 5th, to 31° at New York City on the 5th.

South Atlantic states.—From 22° at Fort Macon, North Carolina, on the 15th, to 33° at Augusta, Georgia, on the 18th.

Florida peninsula.—From 14° at Key West, on the 19th, to 28° at Sanford, on the 18th.

Eastern Gulf.—From 23° at Pensacola, Florida, on the 16th, to 32° at Mobile, Alabama, and Vicksburg, Mississippi, on the 18th and 19th, respectively.

Western Gulf.—From 17° at Galveston, Texas, on the 16th and 17th, to 39° at Fort Smith, Arkansas, on the 1st.

Rio Grande valley.—From 24° at Brownsville, Texas, on the 28th, to 36° at Rio Grande City, Texas, on the 1st.

Tennessee.—From 26° at Memphis, on the 24th, to 33° at Nashville, on the 1st.

Ohio valley.—From 24° at Cincinnati, Ohio, on the 27th, to 32° at Louisville, Kentucky, and Indianapolis, Indiana, on the 23d and 27th, respectively.

Lower lakes.—From 26° at Buffalo, New York, and Erie, Pennsylvania, on the 14th, to 36° at Rochester, New York, on same date.

Upper lakes.—From 24° at Grand Haven, Michigan, and Milwaukee, Wisconsin, on the 14th and 28th, respectively, to 30° at Port Huron, Michigan, on the 14th and 27th.

Extreme northwest.—From 39° at Moorhead, Minnesota, on the 8th, to 49° at Fort Buford, Dakota, on the 27th.

Upper Mississippi valley.—From 22° at Des Moines, Iowa, on the 17th, to 37° at Springfield, Illinois, on the 28th.

Missouri valley.—From 34° at Leavenworth, Kansas, on the 26th, to 48° at Fort Bennett, Dakota, on the 2d.

Northern slope.—From 30° at Helena, Montana, on the 29th, to 45° at Fort Benton, Montana, on the 26th.

Middle slope.—From 21° on the summit of Pike's Peak, Colo-

rado, on the 31st, to 46° at West Las Animas, Colorado, on the 27th and 28th.

Southern slope.—From 35° at Fort Concho, Texas, on the 17th and 26th, to 40° at Fort Stockton, Texas, on the 28th.

Southern plateau.—From 29° at Fort Grant, Arizona, on the 30th, to 40° at El Paso, Texas, and Fort Apache, Arizona, on the 4th and 17th, respectively.

Middle plateau.—23° at Salt Lake City, Utah, on the 17th.

Northern plateau.—From 19° at Lewiston, Idaho, on the 26th, to 30° at Dayton, Washington Territory, on the 30th.

North Pacific coast.—From 14° at Fort Canby, Washington Territory, on the 29th, to 18° at Portland, Oregon, on the 13th.

Middle Pacific coast.—From 15° at San Francisco, California, on the 14th, to 31° at Sacramento, California, on the 2d.

South Pacific coast.—From 24° at San Diego, California, on the 14th, to 32° at Los Angeles, California, on the 15th.

LOW TEMPERATURES.

Boston, Massachusetts.—Extremely cold weather prevailed throughout New England during the 22d and 23d. In this city the temperature fell to —12° on the morning of the 23d, which is the lowest temperature recorded here during December since the establishment of the signal office. The following low temperatures were reported from various points in New England on the 23d: Concord, New Hampshire, —20°; Barre, Vermont, —26°; in the towns around Bellows Falls, Vermont, the temperatures ranged from —16° to —18°. At Plymouth, Massachusetts, the harbor froze over and the temperature fell to from —15° to —18°.

Utica, New York.—During the night of the 22–23d the temperature fell to —22°; at Booneville, Oneida county, to —36°.

Providence, Rhode Island.—The night of the 22–23d was one of the coldest experienced here for several years, the temperature falling to —10°.

Saint John, New Brunswick.—The temperature fell to —18° on the 23d, which is the lowest that has been recorded during the present season.

Augusta, Maine, 23d.—The temperature fell to —28° in the morning. At Rockland it was —10° at sunrise and —8° at noon. At Bangor, the thermometer read from —19° to —22° during the early morning, and at 6 p. m. it read —12°. At Lewiston it was from —14° to —18°.

Professor Charles G. Bœrner, of Vevay, Switzerland county, Indiana, furnishes the following record of low temperatures at that place since 1865, including the low temperature of January 5, 1884:

Year.	Month.	Temp.	Year.	Month.	Temp.
		°			°
1865	January	— 2	1875	January	— 7
1866	February	— 7	1876	December	— 7
1867	February	—10	1877	January	—16
1868	December	— 2	1878	January	— 5
1869	March	+ 6	1879	January	—20.5
1870	December	— 4	1880	December	—11
1871	December	— 7	1881	January	—22
1872	December	— 8	1882	December	— 3
1873	January	— 3.3	1883	January	+ 1
1874	January	+ 3	1884	January 5th	—23

Professor Bœrner, also makes the following note:

On the memorable cold New Year's day, January 1, 1864, in Cincinnati, my standard thermometer registered 16° below zero. The mean temperature of that day was 12°.5 below zero. A corresponding low temperature prevailed on the 3d and 4th of February, 1856, when the minimum temperature was 16° below zero.

FROSTS.

In the various districts they were reported on the following dates:

New England.—1st to 31st.

Middle Atlantic states.—1st to 31st.

South Atlantic states.—1st to 6th, 8th to 18th, 22d, 23d, 24th, 26th, 28th, 29th.

Florida peninsula.—1st, 2d, 13th, 16th, 17th, 18th, 28th, 29th.

Eastern Gulf.—1st, 3d, 4th, 12th, 13th, 15th to 18th, 26th, 28th, 29th.

Western Gulf.—1st, 3d, 8th to 12th, 14th to 20th, 24th, 25th, 27th, 28th, 31st.

Tennessee.—1st to 4th, 9th to 21st, 25th to 29th.

Ohio valley.—1st to 15th, 25th, 26th, 28th, 28th.

Lower lakes.—1st to 7th, 9th to 31st.

Upper lakes.—1st to 31st.

Extreme northwest.—1st to 31st.

Upper Mississippi valley.—1st to 5th, 7th to 31st.

Missouri valley.—1st to 31st.

Northern slope.—1st to 31st.

Middle slope.—1st to 5th, 7th to 31st.

Southern plateau.—3d to 19th, 24th to 31st.

Middle plateau.—1st, 2d, 4th, 6th to 18th, 20th, 21st, 25th, 27th, 31st.

Northern plateau.—1st to 18th, 31st.

North Pacific coast.—1st, 2d, 3d, 6th to 18th, 21st, 22d, 27th, 29th, 30th, 31st.

Middle Pacific coast.—1st, 2d, 7th to 23d, 28th to 31st.

South Pacific coast.—7th, 8th, 24th to 27th, 29th, 30th, 31st.

Frosts were also reported at Fort Concho, Texas, on the 7th, 8th, 9th, 15th, 17th, 19th, 31st; Brownsville, Texas, 7th, 17th.

The Signal Service observer at Jacksonville, Florida, reports that from authentic information received from Osceola, Orange county, the thermometer read 20° at that place on the 16th, and that the orange crop was damaged and the young orange trees were killed. It was also reported that in the orange groves at Enterprise, Volusia county, lumps of ice were found in the oranges. The lowest temperature at Jacksonville during the month was 30°.5, on the 16th.

ICE.

Under the heading "ice in rivers and harbors" in this REVIEW the subject of ice-formation in the northern sections of the country is considered. In the Southern states the following instances of ice-formation have been reported:

Alabama.—Auburn, 15th, 16th, 28th; Mobile, 15th; Montgomery, 15th.

Arizona.—Fort Grant, 8th, 24th, 25th, 30th, 31st; Wickenburg, 8th, 9th, 18th.

Florida.—Cedar Keys, 16th; Limona, 16th, 17th.

North Carolina.—Charlotte, 16th; Fort Macon, 16th.

South Carolina.—Charleston, 16th.

Tennessee.—Memphis, 16th, 17th, 19th, 20th, 21st, 27th, 28th.

Texas.—Barnesville, 31st; El Paso, 9th.

PRECIPITATION.

[*Expressed in inches and hundredths.*]

The distribution of rainfall over the United States and Canada for the month of December, 1883, as determined from reports from more than six hundred stations, is exhibited on chart iv.

The reports from eight New England stations show an average of precipitation of 3.40 for that district, which amount coincides exactly with the normal, as deduced from records of observations made at the same stations, and covering periods of from three to twelve years. For the western Gulf states, lower lake region, Missouri valley, and northern slope, the average precipitation is nearly normal, the departures in the three last-named districts being deficiences ranging from 0.03 to 0.13, and in the western Gulf states, an excess of 0.08 Along the Atlantic coast south of New England, in the eastern Gulf states, northern and middle plateau districts, and on the Pacific coast, the average precipitation is below the normal. The deficiencies are marked in the south Atlantic states, Florida peninsula, northern plateau, and in the north and middle Pacific coast regions. In the south Atlantic states the deficiency amounts to 1.91, in the Florida peninsula, 1.72, and in the northern plateau, north and middle Pacific coast regions, varies from 2.53 to 2.71. In the upper lake region, extreme northwest, Rio Grande valley, middle and southern slopes, and southern plateau, the average precipitation exceeds the normal, the departures varying from 0.25 to 0.91 in the three first-named districts, while in the southern plateau a

marked excess of 2.31 occurs. On the summit of Mount Washington, New Hampshire, the monthly precipitation, 2.66, is less than one-half of the normal amount for December; and on the summit of Pike's Peak, Colorado, it is 0.72, or 0.53 below the December average of the eleven preceding years.

The general distribution of rainfall for the month of December, and the districts of maximum departures from the normal in each year from 1872 to 1882, inclusive, are as follows:

Districts.	Maximum departures.	Year.	Distribution.
		1872	Excessive in Texas, Louisiana, western Mississippi, southern Virginia, North Carolina, eastern Tennessee, South Carolina, Georgia, and Florida; deficient in all other districts east of the Rocky mountains, except slight excesses at New London, Connecticut, Rochester, New York, Leavenworth, Kansas, and Breckenridge, Minnesota.
		1873	Normal in the south Atlantic states and upper lake region; deficient in New England, the middle Atlantic and Gulf states; excessive in the lower lake region, Tennessee, and in the Saint Lawrence, Ohio, and Missouri valleys.
Western Gulf states	+ 2.09	1874	Normal in the middle Atlantic states and in Minnesota; excessive in the western Gulf states; deficient in all other districts east of the Rocky mountains.
Lower lakes	— 1.85		
Saint Lawrence valley	— 1.30		
Upper Mississippi valley	— 1.00		
Upper lakes	— 1.00		
Portland, Oregon	+ 5.64	1875	Normal in Minnesota, the lower lake region, and middle Atlantic states; deficient in New England, the south Atlantic states, and on the middle Pacific coast; excessive in the Gulf states, upper lake region, Tennessee, in the upper Mississippi, Missouri, Ohio, and Saint Lawrence valleys, and in the north Pacific coast region.
Western Gulf states	+ 2.65		
Eastern Gulf states	+ 1.15		
San Francisco, California	— 2.75		
New England	— 1.65		
South Atlantic states	— 0.70		
Eastern Gulf states	+ 3.00	1876	Excessive in the south Atlantic and eastern Gulf states; normal in the upper Missouri and Saint Lawrence valleys; deficient in all other districts.
South Atlantic states	+ 1.65		
Pacific coast	— 4.00		
Upper Mississippi valley	— 1.65		
Ohio valley and Tennessee	— 1.60		
Eastern Gulf states	+ 2.05	1877	Excessive in the upper lake region, Minnesota, upper Mississippi and Missouri valleys, and in the south Atlantic and eastern Gulf states; deficient in all other districts.
Missouri valley	+ 1.14		
New England	— 2.02		
Portland, Oregon	— 1.30		
Lower lakes	— 1.26		
Saint Lawrence valley	+ 3.20	1878	Deficient in California, at Portland, Oregon, and in the upper Missouri valley; excessive in all other districts, except normal in Minnesota.
Lower lake region	+ 2.98		
Eastern Gulf states	+ 2.96		
Portland, Oregon	— 3.05		
California coast	— 2.39		
Tennessee	+ 4.84	1879	Deficient in the south Atlantic and western Gulf states, at Portland, Oregon, in Florida and the upper Missouri valley, the departures being very slight in the two last-named districts; excessive in all other districts east of the Rocky mountains, and also in California.
Ohio valley	+ 2.61		
Saint Lawrence valley	+ 2.44		
California coast	+ 1.92		
Western Gulf states	— 2.14		
South Atlantic states	— 1.62		
Middle Pacific coast	+ 7.25	1880	Normal in New England; excessive in the middle Atlantic states, Florida, eastern Gulf states, Minnesota, upper Missouri valley, and on the Pacific coast; deficient in the lake region, upper Mississippi, lower Missouri, and Ohio valleys, Tennessee, and in the south Atlantic and western Gulf states.
North Pacific coast	+ 5.02		
South Pacific coast	+ 2.63		
Middle Atlantic states	+ 1.16		
Western Gulf states	— 2.09		
Tennessee	— 1.05		
Eastern Gulf states	+ 3.12	1881	Excessive in the lake region, Ohio valley, Tennessee, New England, middle Atlantic and eastern Gulf states, the departures being very slight in the upper lake region and Tennessee; deficient in the south Atlantic states, Florida, and from the Mississippi river westward to the Pacific coast.
Lower lakes	+ 2.11		
Ohio valley	+ 1.51		
South Pacific coast	— 1.83		
Middle Pacific coast	— 1.36		
South Atlantic states	— 0.99		
North Pacific coast	+ 6.87	1882	Normal in the extreme northwest and northern slope; slightly excessive in Florida, the south Atlantic states, lake region, upper Mississippi valley, and northern plateau; large excess on the north Pacific coast; deficient in California, the middle and southern plateau districts, southern slope, Gulf states, Tennessee, middle Atlantic states, New England, and in the Ohio and Missouri valleys.
Florida peninsula	+ 0.45		
Middle Pacific coast	— 4.14		
Tennessee	— 2.90		
South Pacific coast	— 1.44		
Eastern Gulf states	— 1.20		

In the first column of the following table is given the average precipitation for December in each of the various districts for several years, as determined from observations made at the Signal Service stations; in the second column are given the averages for December, 1883, and the third column shows the excess or deficiency of December, 1883, as compared with the average:

Average precipitation for December, 1883.

Districts.	Average for December. Signal-Service observations.		Comparison of Dec., 1883, with the average for several years.
	For several years.	For 1883.	
	Inches.	*Inches*	*Inches.*
New England	3.40	3.40	normal.
Middle Atlantic states	3.60	2.99	0.61 deficiency.
South Atlantic states	4.40	2.49	1.91 deficiency.
Florida peninsula	2.42	0.70	1.72 deficiency.
Eastern Gulf states	5.27	4.88	0.39 deficiency.
Western Gulf states	3.78	3.86	0.08 excess.
Rio Grande valley	1.14	1.83	0.69 excess.
Tennessee	4.54	4.87	0.33 excess.
Ohio valley	3.76	4.22	0.46 excess.
Lower lakes	2.82	2.75	0.07 deficiency.
Upper lakes	2.01	2.31	0.30 excess.
Extreme northwest	0.87	1.24	0.37 excess.
Upper Mississippi valley	2.10	1.66	0.44 deficiency.
Missouri valley	1.00	0.87	0.13 deficiency.
Northern slope	0.89	0.80	0.03 deficiency.
Middle slope	0.50	1.41	0.91 excess.
Southern slope	0.78	1.03	0.25 excess.
Southern plateau	0.87	3.15	2.31 excess.
Northern plateau	4.79	2.08	2.71 deficiency.
North Pacific coast	8.39	5.74	2.65 deficiency.
Middle Pacific coast	3.10	0.63	2.53 deficiency.
South Pacific coast	2.54	2.19	0.35 deficiency.
Mount Washington, N. H.	5.50	2.66	2.84 deficiency.
Pike's Peak, Col.	1.25	0.72	0.53 deficiency.
Salt Lake City, Utah	1.44	1.20	0.24 deficiency.

DEVIATIONS FROM AVERAGE PRECIPITATION.

The departures exhibited by the reports from the regular Signal Service stations are shown in the table of average precipitation for December, 1883. Voluntary observers report the following notes in connection with this subject:

Florida.—Mayport, Duval county: monthly rainfall, 0.64, is 2.23 below the December average of the last ten years.

Illinois.—Anna, Union county: monthly precipitation, 5.14, is 1.97 above the December average of the last eight years.

Riley, McHenry county: monthly precipitation, 1.67, is 0.27 below the December average of the last twenty-three years. The total precipitation for the year ending December 31st, is 35.91, or 1.95 above the annual average of twenty-two years.

Mattoon, Coles county: monthly precipitation, 2.60, is 0.34 below the December average of the last four years.

Indiana.—Wabash, Wabash county: monthly precipitation, 2.37, is 0.07 below the December average of eight years. The total rainfall for 1883 is 51.54, or 12.49 above the annual average for a period of eight years.

Logansport, Cass county: monthly precipitation, 2.09, is 0.40 below the December average of the last twenty-four years. The total snow-fall for December, 1883, is 17.75, or about 8.50 above the December average of the last twenty-four years.

Kansas.—Independence, Montgomery county: monthly precipitation, 1.66, is 0.78 below the December average of eleven years.

Wellington, Sumner county: monthly precipitation, 1.40, is 0.73 above the December average of the four preceding years.

Lawrence, Douglas county: monthly precipitation, 0.77, is 0.88 below the December average of fifteen years. The total depth of snow was 2.00, or 4.05 below the December average.

Maine.—Gardiner, Kennebec county: monthly precipitation, 3.67, is about the December normal of the last forty-eight years. The total precipitation for 1883 is 38.88, or 5.35 below the annual average.

Maryland.—Fallston, Harford county: monthly precipitation, 5.23, is 1.97 above the December average of thirteen years.

Massachusetts.—Somerset, Bristol county: the total precipi-

Table of Excessive. and Greatest and Least Monthly Precipitation.

Station.	Specially heavy.			Largest monthly.	Smallest monthly.	
	Date.	Amt.	Duration	Amount.	Station.	Amt
Alabama.					*Arizona.*	
Green Springs	7, 8	2.40			Pantano	0.19
Arizona.					Benson	0.50
Prescott	20, 21	2.86			*California.*	
Arkansas.					Willows	0.05
Mount Ida	5, 6	3.50			Goshen	0.10
Fayetteville	5, 6	3.00			Princeton	0.14
Fort Smith	5, 6	2.30			Williams	0.15
California.					Antioch	0.20
Fort Gaston	24, 25	6.60		9.10	Sumner	0.20
Florida.					Dagget	0.29
Pensacola	7, 8	2.91			Orland	0.29
Georgia.					Woodland	0.29
Camp Mitchell	7, 8	2.38			Kingsburg	0.30
Illinois.					Borden	0.31
Anna	22, 23	2.33			Fresno	0.34
Indiana.					Dunnigan	0.35
Huntingburg	23	3.44		6.24	San José	0.37
Hanover				6.12	Marysville	0.40
Salem	23	3.12			Davis	0.43
Marengo	23	3.10			Brighton	0.44
Princeton	23	3.10			Livermore	0.44
Vevay	22, 23	2.90			Modesto	0.44
Corydon	23	2.60			Tehama	0.44
Blue Lick	24	2.34			Knight's Landing	0.45
Miami	23	2.01			Solidad	0.45
Martinsville	29	2.00			Tulare	0.47
Iowa.					Chico	0.50
Oskaloosa	16	2.50			*Dakota.*	
Kentucky.					Fort Sisseton	0.35
Frankfort	22, 23	2.10			Fort Hale	0.40
Louisville	23	2.07			Fort Yates	0.43
Maryland.					*Florida.*	
Fallston	23	2.52			Archer	0.21
Mississippi.					Saint Augustine	0.26
Vicksburg	6, 7	2.03		9.42	Mayport	0.44
Do	30, 31	5.86			*Kansas.*	
North Carolina.					Salina	0.09
Brevard	7, 8	2.10			Manhattan	0.45
Nova Scotia.					Holton	0.50
Halifax				6.27	*Missouri.*	
Ohio.					Jefferson Barracks	0.39
College Hill	23, 24, 25	4.50		7.25	*Montana.*	
Cincinnati	23	2.57			Fort Keogh	0.00
Oregon.					Fort Assinniboine	0.21
Portland	24, 25	2.18		6.34	*Nebraska.*	
Roseburg	24, 25	2.82			Weeping Water	0.00
Albany	24	2.60			Table Rock	0.24
Eola	24	2.03			Lincoln	0.25
South Carolina.					Inavale	0.25
Charleston	27	2.42			Johnson	0.26
Tennessee					Stella	0.28
Memphis	23, 24	2.63			Syracuse	0.30
Texas.					Crete	0.39
Clarksville	6	2.08			Nebraska City	0.40
Galveston	6	2.04			Pawnee City	0.40
Washington Territory.					Utica	0.40
Neah Bay				11.83	Ashland	0.50
Bainbridge Island	26	2.10			Beaver Creek	0.50
					Central City	0.50
					Nevada.	
					Reno	0.00
					Hot Springs	0.03
					Carson City	0.06
					Brown's	0.07
					Wadsworth	0.25
					Golconda	0.31
					Tecoma	0.36
					Humboldt	0.37
					Bishop's Creek	0.38
					Battle Mountain	0.40
					Winnemucca	0.45
					New Mexico.	
					Lordsburg	0.20
					Utah.	
					Blue Creek	0.00
					Kelton	0.16
					Terrace	0.30
					Promontory	0.41

tation for the year 1883 is 37.68, or 8.63 below the annual average of ten years.

Worcester, Worcester county: monthly precipitation, 2.48, is 1.37 below the December average of a period of forty-five years. The total precipitation for 1883 is 32.52, or 13.97 below the annual average for the same period.

Westborough, Worcester county: total precipitation for the year 1883 is 33.61, or 10.00 below the annual average of five years.

New Hampshire.—Antrim, Hillsborough county: monthly precipitation. is 3.65, or 0.07 above the December average of ten years.

Grafton, Grafton county: monthly precipitation, 3.05, is 0.72 below the December average of five years.

New Jersey.—South Orange, Essex county: monthly precipitation, 4.06, is 0.18 above the December average of fourteen years. The total snow-fall of the month, twenty-six inches, is the largest December snow-fall of the last fourteen years, except for December, 1872, when thirty-eight inches fell.

New York.—North Volney, Oswego county: monthly precipitation, 2.85, is 0.52 below the December average of twelve years. The total precipitation for 1883 is 37.65, or 0.93 above the annual average of eleven years.

Palermo, Oswego county: monthly precipitation, 2.78, is 1.37 below the December average of the last thirty years. The total snow-fall, 5.00, is 13.00 below the December average of the same period; the largest December snow-fall, 68.00, fell in 1868; the smallest, 4.00, fell in 1881. The total precipitation for 1883 is 32.91, or 5.79 below the annual average of a period of thirty years; the largest annual precipitation of that period is 52.50 for 1866; the smallest, 26.92, for 1882.

Ohio.—The following table shows the monthly and annual precipitation at Wauseon, Fulton county, as determined from observations made by Mr. Thomas Mikesell. The record covers periods from March, 1871, to December, 1872, and from May 1873, to December, 1883:

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual precipitation.
1871	.....	.....	2.05	3.53	2.80	3.09	4.16	2.77	0.55	0.95	3.45	1.66	.....
1872	1.32	0.82	0.97	1.31	3.72	1.43	7.26	4.26	3.78	1.38	1.87	2.95	31.07
1874	.....	.....	.....	.....	1.70	5.47	2.89	1.44	0.66	0.93	2.77	0.41	.....
1875	2.14	2.68	3.40	1.53	6.06	6.06	1.60	3.82	2.23	3.42	2.38	2.96	38.28
1876	2.57	6.81	6.32	1.53	6.13	6.36	6.37	2.23	4.12	2.82	2.51	1.64	49.58
1877	2.02	0.12	5.61	3.07	1.14	8.21	3.79	2.74	1.56	4.88	4.02	1.40	38.56
1878	2.14	3.26	3.78	3.21	4.70	2.58	4.28	4.03	1.89	2.42	2.72	2.23	37.24
1879	1.29	1.50	2.88	2.51	3.06	2.82	4.20	2.72	5.29	0.95	5.15	4.32	36.69
1880	3.53	1.48	2.78	4.81	6.25	3.31	4.99	4.72	2.69	2.67	2.54	1.23	41.00
1881	1.77	4.28	3.73	1.55	1.33	8.43	5.03	1.25	2.36	8.92	5.83	3.58	48.06
1882	2.14	2.91	3.43	2.33	4.96	3.18	2.57	3.48	1.35	2.59	2.81	1.81	33.56
1883	1.72	5.11	1.70	1.63	5.97	4.73	6.44	1.67	2.96	4.37	2.88	2.41	41.59
Average	2.11	2.82	3.35	2.46	3.98	4.64	4.44	2.93	2.45	3.02	3.24	2.22	39.56

From the above record it will be seen that the precipitation for December, 1883, is slightly in excess of the average.

In the following table are shown the total snow-falls for the months from October to May, inclusive, since 1871, with the exception of the cold season of 1873–4, at Wauseon:

Month.	1871–2	1874–5	1875–6	1876–7	1877–8	1878–9	'79–80	1880–1	1881–2	1882–3	Average
October	0.00	0.00	0.75	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.17
November	5.40	15.75	11.70	9.70	1.60	3.00	5.05	12.60	3.15	7.36	7.53
December	8.05	0.80	4.55	16.65	0.80	18.80	7.65	6.40	1.60	17.45	8.27
January	11.70	18.15	1.10	11.30	16.95	7.90	0.55	15.50	4.60	10.55	9.83
February	5.30	14.90	7.45	0.80	15.80	10.35	4.50	20.15	1.90	6.00	8.71
March	4.25	25.30	30.30	41.70	0.15	10.25	5.20	13.60	4.10	15.95	15.08
April	3.00	2.80	0.00	0.90	0.00	4.75	0.00	5.85	0.05	0.00	1.73
May	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.50	0.66
Total	37.70	77.80	55.85	81.05	35.30	55.05	22.95	75.10	15.40	63.80	*52.02

* Annual average.

Pennsylvania.—Dyberry, Wayne county: monthly precipitation, 2.33, is 0.16 below the December average of the last fifteen years.

Texas.—The following table, compiled from records of observations made by Dr. Frederick Pettersen, of Comfort, Kendall county, shows the monthly and annual rainfall at that place since May, 1877:

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October	November.	December.	Total.
1877	.....	.....	.....	.....	1.86	1.98	0.35	2.53	3.39	5.49	2.26	0.16	18.04
1878	1.02	1.94	0.30	1.83	6.20	3.32	1.90	2.03	0.15	0.50	0.68	0.22	20.09
1879	0.10	0.87	0.00	4.05	1.12	1.80	0.25	3.00	1.49	0.84	0.20	0.10	13.88
1880	2.90	2.16	0.72	3.56	5.66	1.02	2.90	6.44	7.94	1.40	1.97	1.55	38.22
1881	0.14	0.40	1.40	2.10	4.66	0.00	1.76	0.30	3.22	3.86	1.40	0.30	19.54
1882	2.60	2.80	1.72	1.00	3.76	0.00	4.42	4.50	0.96	2.71	0.75	1.45	26.67
1883	0.00	0.65	3.02	0.80	0.00	0.80	4.10	0.00	0 98	1.64	0.66	2.18	14.25
Aver'ge	1.13	1.47	1.19	2.22	3.32	1.27	2.24	2.69	2.59	2.35	1.13	0.85	*22.11

*Annual average of six years.

From the above table it will be seen that the precipitation for December, 1883, is 1.33 inches above the average.

New Ulm, Austin county: monthly rainfall, 2.61, is 2.35 below the December average of twelve years. The largest December rainfall of that period, 16.43, occurred in 1875; the smallest, 0.44, occurred in 1880.

Virginia.—Variety Mills, Nelson county: monthly precipitation, 2.22, is 1.88 below the December average of the last five years.

Wytheville, Wythe county: monthly precipitation, 2.90, is the December normal for a period of nineteen years.

West Virginia.—Helvetia, Randolph county: monthly precipitation, 5.15, is 0.51 above the December average of seven years. The total precipitation for 1883 is 61.53, or an excess of 4.17 over the annual average of seven years.

Washington Territory.—New Tacoma, Pierce county: the total precipitation for 1883, up to December 27th, is 27.61, or 23.59 below the annual average of the five preceding years.

SNOW.

The dates on which snow is reported to have fallen in the northern districts are as follows:

New England.—1st, 2d, 3d, 5th, 8th to 28th, 30th, 31st.

Middle Atlantic states.—2d, 5th, 8th, 9th, 11th, 12th, 14th, 16th to 26th, 28th, 30th.

Ohio valley.—13th to 25th, 27th, 28th, 31st.

Lower lakes.—1st, 2d, 3d, 5th, 9th to 12th, 14th to 24th, 26th to 31st.

Upper lakes.—1st, 2d, 5th, 6th to 31st.

Extreme northwest.—6th to 9th, 13th to 17th, 19th to 23d, 25th to 31st.

Upper Mississippi valley.—7th, 8th, 13th to 23d, 25th to 31st.

Missouri valley.—1st, 4th, 6th, 7th, 13th to 23d, 25th, 26th, 28th to 31st.

Northern slope.—5th, 6th, 13th, 15th to 23d, 25th to 31st.

Middle slope.—1st, 4th to 7th, 13th to 20th, 22d, 23d, 26th, 28th to 31st.

Middle plateau.—2d to 6th, 19th to 26th, 28th to 31st.

Northern plateau.—4th, 5th, 7th, 18th to 26th, 28th, 29th, 30th.

North Pacific coast.—19th, 22d to 25th, 27th to 30th.

In the southern districts snow is reported to have fallen as follows:

Arizona.—Fort Apache, 5th; San Carlos, 5th; Fort Bowie, 10th; Fort Grant, 11th.

Georgia.—Atlanta, 17th.

North Carolina.—Fort Macon, New River Inlet, Sloop Point, and Wilmington, 17th; Kitty Hawk and Wash Woods, 17th and 23d.

Tennessee.—Chattanooga, 16th, 17th; Memphis, 19th; Nashville, 14th, 15th.

Texas.—Fort Stockton, 10th.

The following reports of snow storms of unusual severity have been received:

Denver, Colorado, 6th.—One of the most disastrous snow storms that has ever occurred here, prevailed during the 5th and 6th. Snow began falling at noon of the 5th, and continued all night. At 4 a. m. of the 6th the wind blew with great force. More than three hundred telegraph poles, eighteen inches in diameter, were blown down. The telephone company sustained damage estimated at $15,000. Several streets were blockaded and all outside communication was cut off. Trains on the Union Pacific railroad were delayed thirty-six hours, being stopped by snow-drifts at Hugo, one hundred miles southeast of Denver.

Mount Carmel, Northumberland county, Pennsylvania, 19th.—Snow fell to a depth of thirteen inches on this date, causing suspension of work in several collieries, and impeding railroad travel.

Albany, New York, 19th.—The heavy snow-fall of that date caused interruption to railroad travel.

Denver, Colorado, 24th.—Reports from Ouray, in southwestern Colorado, state that on the 21st a huge mass of snow started from the top of Mount Snefles, and, increasing in size as it descended, struck a building (in which were eleven men) at the foot of the mountain. The building was completely swept away, and the inmates were buried beneath from fifteen to twenty feet of snow. Five of them were seriously injured and six were killed. The snow-slide was the result of warm weather; snow-slides are of common occurrence in the mountainous regions late in spring, but are very unusual at this season. Reports from the mountain towns state that there has been an unusual snow-fall, it being from four to six feet deep on the level.

Petersburg, Virginia.—Snow fell to a depth of four inches at this place on the 23d.

Highland, Madison county, Illinois.—A severe snow and sleet storm prevailed here during the night of the 22–23d. All trains arriving were delayed from one to five hours.

Pittsburg, Pennsylvania.—A heavy snow storm occured here on the 23d, causing delay of trains and prostration of telegraph lines. Snow began at daylight and continued until dusk, when it changed to a steady rain. The streets were rendered almost impassable and many cellars were flooded.

Chicago, Illinois.—A snow storm of wide extent prevailed over this region on the 22d and 23d, followed by sleet, and in some places rain. Trains due here were delayed from one to ten hours, and telegraphic communication was seriously interrupted, especially between Chicago and points south and east.

Ashland, Jackson county, Oregon.—The snow in the mountains between this place and Linkville, Lake county, was from four to five feet deep on the 24th.

Lancaster, Lancaster county, Pennsylvania.—The Farmer's Northern Market building, a large brick structure, (dimensions, 244 by 87 feet), was totally demolished at about 3 a. m. of the 24th. The disaster was caused by the supports of the roof giving way under a heavy weight of snow. The damage is estimated at $53,000. No lives were lost, owing to the early hour at which the accident occurred.

Oswego, New York, 24th.—The New York, Ontario, and Western train, due at 11 a. m. of this date, was delayed two hours by snow.

New York City.—The heavy snow-fall of the 25th caused much damage in Queens and Suffolk counties, but it did not impede railroad travel. At Flushing, Long Island, the heavy weight of snow crushed in the roofs of barns and other buildings.

LARGEST MONTHLY SNOW-FALLS.

[*Expressed in inches.*]

The following are the largest monthly snow-falls reported from the various states and territories during the month:

California.—Summit, 32; Cisco, 27; Emigrant Gap, 24.25; Alta, 5.

Colorado.—Denver, 22.9; Fort Lewis, about 14; Pikes Peak, 7.2; Golden, 5.38; Pueblo, 5.

Connecticut.—Southington, 25.25; New Haven, 25; Bethel, 22; New London, about 18.

Dakota.—Fort Totten, 28.4; Pembina, 17.2; Fort Bennett, about 10; Webster, 8.2; Bismarck, 7.5; Alexandria, 6.6.

Delaware.—Saint George's, 9.

District of Columbia.—West Washington, 5.4.

Illinois.—Polo, 15.5; Rockford, 15.13; Riley, 14.75; Springfield, 13.5; Chicago, 12.3; Mattoon, 7.9; Larchland, 6.5; Peoria, 6; Bunker Hill, 5.

Indiana.—Indianapolis, about 24; Griffin Station, 23.5; Richmond, 20.55; Lafayette, 18; Logansport, 17.75; Sunman, 15; Wabash, 13.25; Noblesville, 13; Worthington, 12; Vevay, 11.6; Hanover, 9; Fort Wayne, 7.5; Salem, 7.5; Terre Haute, 7; Dunkirk, 6.1; Marengo, 5.

Iowa.—Independence, 20; Dubuque, 15.3; Humboldt, 11.91; Muscatine, 11; Fort Madison, 10.5; Monticello, 9.7. Keokuk, 8.8; Cedar Rapids, 8.5; Des Moines, about 8; Cresco, 7; Davenport, 6.9; Indianola, 6.75; Nora Springs, 5.

Kentucky.—Frankfort, 6.75; Louisville, about 6.

Maine.—Cornish, 24; Eastport, 24; Portland, about 18.5; Gardiner, 18.25; Orono, 12.

Maryland.—Cumberland, 16; Fallston, 12.5; Baltimore, about 10; Emmittsburg, 10; Sandy Springs, 7.7.

Massachusetts.—Boston, 31; Charlestown, 31; Westborough, 28.5; New Bedford, 26; Milton, 25; Taunton, 24.5; Mendon, 24; Somerset, 24; Princeton, 23.6; Fall River, 23; Worcester, 19.25; Rowe, 19; Amherst, 16.5; Provincetown, 11.

Michigan.—Northport, 29.25; Traverse City, 19.5; Alpena, about 18; Milwaukee, 17; Marquette, about 16.6; Hudson, 16.46; Fort Brady, about 16; Ionia, 14.75; Detroit, about 12; Grand Haven, about 12; Hillsdale, 11.65; Grand Rapids, 11; Lansing, 11; Escanaba, about 9; Coldwater, 8.5; Marshall, 7.78; Port Huron, 5.4.

Minnesota.—Duluth, 20; Moorhead, about 14; Minneapolis, 10.38; Northfield, 7.5; Saint Paul, about 7.

Montana.—Fort Custer, 15; Fort Ellis, 9.2; Helena, 9; Fort Shaw, 5.4.

Nebraska.—Genoa, 8.5.

Nevada.—Truckee, 16; Halleck, 8.5; Wells, 8; Otego, 7.25; Elko, 7.12; Carlin, 7; Boca, 6; Toano, 6; Beowawe, 5.5.

New Hampshire.—Mount Washington, 22.2; Antrim, 20; Grafton, 20; Bristol, about 18; Contoocookville, 18; Lake Village, 17.1; Wolfborough, 17; Woodstock, about 17; Weirs Bridge, 15.5; Belmont, 14.2; Ashland, 12.7.

New Jersey.—Somerville, 28.4; South Orange, 26; Paterson, 25.5; Caldwell, 21.2; Readington, 20; Moorestown, 11; Vineland, 8.75.

New Mexico.—Fort Wingate, about 7.

New York.—Oswego, about 25; White Plains, 24; Fort Hamilton, 23.8; New York City, about 23.5; Flushing, 23; Mountainville, 18.5; Friendship, 18; Humphrey, 18; Albany, 17; Auburn, 16; Port Jervis, 16; Ardenia, 15.5; Johnstown, 15.25; Rochester, 14.2; Cooperstown, 14; Penn Yan, 13.25; Menand Station (near Albany) 13; Factoryville, 12.5; Hector, 7; Ithaca, 6; Palermo, 5.

Ohio.—College Hill, 26.25; Cincinnati, 17.5; North Lewisburg, 15.5; Columbus, about 12; Westerville, 12; Sandusky, 10.3; Cleveland, 8.4; Canal Dover. 6.

Oregon.—Fort Klamath, more than 24.

Pennsylvania.—Grampian Hills, 20; Easton, 17.5; Dyberry, 17; Fallsington, 15.25; West Chester, 14.25; Millville, 13.3; Chambersburg, 13.25; Erie, about 13; Philadelphia, about 11.5; Catawissa, 10.8; Leetsdale, 10.5; Wilkesbarre, 10.4; Wellsborough, 7.8; Troy, 6.4.

Rhode Island.—Block Island, about 11.

Utah.—Ogden, 7.5; Logan, 5.

Vermont.—Woodstock, 17.9; Strafford, 17; Lunenburg, 16; Newport, 12.35; Charlotte, 10; Burlington, 8.

Virginia.—Accotink, 6; Fort Myer, 5.5.

Washington Territory.—Fort Spokane, 15.

West Virginia.—Helvetia, 19.75; Wellsburg, 10.

Wisconsin.—Lancaster, 22.12; Madison, 15.3; Beloit, 13.2; Neillsville, 11.5; Embarrass, about 11; Sussex, 10.9; Ripon, 5.7.

Wyoming.—Fort Bridger, 9; Cheyenne, 8.

DEPTH OF UNMELTED SNOW ON GROUND AT END OF MONTH.

Colorado.—Pike's Peak, 8; Golden, 7.38; Denver, 2; Pueblo, 2; West Las Animas, 1.5.

Connecticut.—Bethel, 6; New Haven, 6; Southington, 6; New London, 3.5.

Dakota.—Fort Yates, about 9; Deadwood, 8; Fort Buford, 8; Alexandria. 6; Rapid City, 5; Webster, 5; Bismarck, 4, Vermillion, 3; Yankton, 2.5; Fort Bennett, 2; Huron, 2.

Delaware.—Saint George's, 2.

District of Columbia.—Washington City, 1.5; West Washington, trace.

Illinois.—Polo, 13; Riley, 13; Springfield, 6; Chicago, 4; Larchland, 4.

Indiana.—Lafayette, 5; Logansport, 5; Indianapolis, 4; Fort Wayne, 3; Wabash, 3; Griffin Station, 1.

Iowa.—Independence, about 14; Monticello, 9; Des Moines, 3 to 8; Guttenburg, 7; Humboldt, 7; Muscatine, 7; Cresco, 6; Dubuque, 3; Nora Springs, 3; Keokuk, 2.5; Cedar Rapids, 2; Davenport, trace.

Kansas.—Salina, 2.5; Independence, 2; Manhattan, 2; Allison, 1.5; Fort Scott, 1; Leavenworth, 1; Dodge City, 0.5; Clay Centre, trace; Wellington, trace.

Maine.—Cornish, 13; Gardiner, 5.5; Eastport, 4; Orono, 3; Portland, 3.

Maryland.—Cumberland, 7; Emmittsburg, 7; Fallston, 3; Sandy Springs, 2; Baltimore, trace.

Massachusetts.—Heath, 18; Westborough, 18; Worcester, about 14; Mendon, 12; Rowe, 12; Charleston, 9; Boston, 8; Milton, 8; Somerset, 8; Fall River, 3.

Michigan.—Northport, 8.1: Hillsdale, 6; Hudson, 6; Ionia, 6; Marquette, 6; Traverse City, 6; Escanaba, 4.5; Mackinaw City, 4; Grand Haven, 3.5; Port Huron, 3.5; Alpena, 3; Detroit, 1.5.

Minnesota.—Saint Paul, 15.75; Duluth, 14; Moorhead, 8; Minneapolis, 6; Northfield, 5; Saint Vincent, 3.

Montana.—Fort Custer, 4; Fort Shaw, 3; Fort Assinniboine, 1; Fort Benton, 1; Helena, 1.

Nebraska.—North Platte, 2.5; Fremont, 0.75; Clear Creek, 0.5; Crete, 0.5; Stockham, 0.5; Omaha, trace.

New Hampshire.—Mount Washington, 12; Grafton, 10.

New Jersey.—Caldwell, 9; South Orange, 8; Somerville, 7; Paterson, 6; Moorestown, 4.5; Sandy Hook, 3.

New York.—Flushing, 15; White Plains, 12; Ardenia, 8; Auburn, 8; Cooperstown, 8; Humphrey, 8; Penn Yan, 8; Mountainville, 7; Menand Station, (near Albany) 7; Albany, 6; Friendship, 6; Rochester, 5; Oswego, 4.5; Hector, 4; Johnstown, 4; Factoryville, 3; Ithaca, 2; Palermo, 2; Buffalo, trace.

Ohio.—Jacksonburg, 20; North Lewisburg, 6; Cincinnati, 3.5; Cleveland, 3; Westerville, 3; Columbus, 1.5; Toledo, 1.5; Canal Dover, trace.

Pennsylvania.—Grampian Hills, 12; Erie, 10; Dyberry, 9; Millville, 7; Fallsington, 6; Philadelphia, 6; Chambersburg, 5.5; Wellsborough, 3.4; Catawissa, 3; West Chester, 3; Wilkesbarre, 2.5; Troy, 1; Leetsdale, trace.

Utah.—Logan, 3; Nephi, 3; Salt Lake City, 1 to 3.

Vermont.—Strafford, 12; Woodstock, 9; Burlington, 6; Charlotte, 5; Newport, 4.

Virginia.—Accotink, trace.

Washington Territory.—Dayton, 3; Port Angeles, 3.

Wisconsin.—Lancaster, 10; Madison, 8; Sussex, 8; Neillsville, 7; Beloit, about 6; Embarrass, 5; Ripon, 5; Milwaukee, 4.5; La Crosse, 3.5.

Wyoming.—Cheyenne, 3.

SNOW FROM A CLOUDLESS SKY.

Duluth, Minnesota.—It is reported that at 9 p. m. of the 1st snow fell from a cloudless sky for several minutes, in the southern outskirts of this city. There were no clouds visible, except a few over Lake Superior.

SLEET.

Sleet is reported to have fallen in the northern districts as follows:

New England.—3d, 19th, 24th, 31st.

Middle Atlantic states.—1st, 2d, 18th, 19th, 21st, 23d to 27th, 30th, 31st.

Ohio valley.—22d, 23d.

Lower lakes.—3d, 4th, 8th to 12th, 14th, 18th, 23d, 24th, 31st.

Upper lakes.—23d.

Extreme northwest.—7th.

Upper Mississippi valley.—22d, 23d, 29th, 30th.

Missouri valley.—17th to 23d, 29th, 30th.

Middle slope.—19th to 23d, 29th.

Sleet is also reported to have fallen at the following stations:

Little Rock, Arkansas, 18th.

Ogreeta, North Carolina, 24th.
Wilmington, North Carolina, 17th.
Memphis, Tennessee, 19th.
Nashville, Tennessee, 18th to 21st.
Cleburne, Texas, 10th.
Fort Canby, Washington Territory, 29th.

Table of rainy and cloudy days, relative humidity, and dew-point for Dec., 1883.

Districts.	Rainy days.	Cloudy days.	Rel. humidity.*	Dew-point.
			Percentages.	° °
New England	From 13 to 21	From 9 to 13	From 73.3 to 80.5	From 16.8 to 29.5
Middle Atlantic states	" 11 " 21	" 5 " 10	" 63.0 " 78.4	" 22.4 " 37.2
South Atlantic states	" 3 " 15	" 1 " 8	" 60.6 " 81.6	" 35.3 " 52.6
Florida peninsula	" 4 " 8	" 1 " 2	" 76.7 " 79.2	" 54.2 " 64.3
East Gulf states	" 10 " 16	" 8 " 12	" 70.8 " 75.6	" 43.7 " 50.6
West Gulf states	" 7 " 14	" 8 " 12	" 67.2 " 81.3	" 32.6 " 53.2
Rio Grande valley	" 7 " 10	" 9 " 10	" 78.0 " 84.8	" 53.0 " 59.6
Ohio valley	" 16 " 17	" 9 " 16	" 68.1 " 78.1	" 24.5 " 32.6
Tennessee	" 16 " 18	" 8 " 16	" 68.8 " 73.6	" 35.6 " 37.4
Lower lakes	" 17 " 25	" 8 " 24	" 67.0 " 80.4	" 20.8 " 27.9
Upper lakes	" 11 " 23	" 7 " 26	" 70.2 " 82.7	" 9.2 " 21.5
Extreme northwest	" 6 " 16	" 4 " 8	" 65.9 " 86.1	" — 2.4 " 5.5
Upper Mississippi valley	" 10 " 14	" 6 " 12	" 60.7 " 73.6	" 10.7 " 32.5
Missouri valley	" 8 " 16	" 5 " 7	" 66.0 " 75.8	" 9.7 " 24.0
Northern slope	" 3 " 11	" 5 " 12	" 48.0 " 74.0	" 15.3 " 21.7
Middle slope	" 5 " 11	" 2 " 6	" 61.3 " 67.7	" 19.4 " 25.6
Southern slope	" 6 " 7	" 5 " 6	" 63.0 " 71.9	" 33.9 " 38.0
Southern plateau	" 2 " 10	" 3 " 7	" 55.9 " 70.5	" 28.3 " 35.3
Northern plateau	" 3 " 15	" 8 " 10	" 73.2 " 83.5	" 26.3 " 27.9
North Pacific coast	" 13 " 24	" 10 " 13	" 83.3 " 86.6	" 35.4 " 40.2
Middle Pacific coast	" 3 " 9	" 4 " 5	" 79.3 " 88.5	" 37.6 " 44.2
South Pacific coast	" 6 " 7	Two	" 63.8 " 64.7	" 42.0 " 43.6
Mt. Washington, N. H.	Twenty-one	Nine	81.6	6.7
Pike's Peak, Col.	Nine	Two	80.6	3.3

* Relative humidity corrected for altitude.

WINDS.

The most frequent directions of the wind during December, 1883, at the Signal Service stations are shown on chart iii. by arrows flying with the wind. On the Atlantic coast north of Virginia the prevailing winds were from the north and northwest, except at New York City, where they were southwest; on the south Atlantic coast, from northeast and southwest; along the immediate Gulf coast, from the north; in the lower lake region and Ohio valley, from south and southwest; in Tennessee, from south and southeast; in the upper lake region, upper Mississippi and Missouri valleys, from north to west; in Oregon and Washington Territory, from southeast to southwest; in southern California, from northeast.

TOTAL MOVEMENTS OF THE AIR.

[*In miles.*]

In the following table are given the stations reporting the largest and smallest total movements of the air in each of the various districts:

Districts.	Stations reporting largest.	Miles.	Stations reporting smallest.	Miles.
New England	Block Island, R. I.	13,367	New Haven, Conn.	5,800
Middle Atlantic states	Cape May, N. J.	12,615	Lynchburg, Va.	2,365
South Atlantic states	Kitty Hawk, N. C.	10,034	Augusta, Ga.	1 723
Florida peninsula	Key West	6,600	Sanford	3,686
East Gulf states	New Orleans, La.	5,556	Montgomery, Ala.	2,787
West Gulf states	Indianola, Tex.	10,326	Little Rock, Ark.	3,844
Ohio valley	Louisville, Ky.	6,433	Cincinnati, Ohio.	3,986
Tennessee	Nashville	4,935	Chattanooga	4,250
Lower lakes	Buffalo, N. Y.	9,965	Toledo, Ohio	6,697
Upper lakes	Milwaukee, Wis.	10,132	Chicago, Ill.	5,945
Extreme northwest	Saint Vincent, Minn.	7,746	Fort Buford, Dak.	5,304
Upper Mississippi valley	Sprnigfield, Ill	7,692	Saint Paul, Minn.	3,883
Missouri valley	Omaha, Nebr.	7,076	Fort Bennett, Dak.	4,304
Northern slope	Cheyenne, Wyo.	7,914*	North Platte, Nebr.	4,686
Middle slope	Fort Elliott, Texas	8,472	West Las Animas, Colo	5,835
Southern slope	Fort Concho, Tex.	6,094	Fort Stockton, Tex.	3,552 *
Southern plateau	Fort Grant, Ariz.	6,097	El Paso, Tex.	3,105
Northern plateau	Dayton, Wash. T.	3,708	Lewiston, Idaho	1,543
North Pacific coast	Fort Canby, Wash. T.	8,933	Roseburg, Oreg.	1.724
Middle Pacifl ccoast	Cape Mendocino, Cal.	11,895	Sacramento, Cal.	2,845
South Pacific coast	Los Angeles, Cal	4,391	San Diego, Cal.	4,034

* For thirty days.

On the summits of Mount Washington and Pike's Peak the total movements of the air were 29,035 and 17,409 miles, respectively, the record at the former station being incomplete on account of frost-work.

HIGH WINDS.

On the summit of Mount Washington velocities of fifty miles or more per hour occurred on the following dates: from 1st to 19th, 22d to 29th. The highest velocities recorded were: 80, nw., 2d; 100, nw., 3d; 90, nw., 15th; 88, w., 18th; 108, nw., 22d; 124, nw., 23d; 80, nw., 29th. The maximum velocity for the month occurred on the 28th; at 12.54 p. m. the registering instrument was blown away, and it was not possible to replace it during the hurricane; a velocity of 132 miles per hour was recorded by holding the anemometer before the wind; the observer estimates the maximum velocity at 150 miles.

On the summit of Pike's Peak velocities of fifty miles or more per hour occurred on the 15th, 16th, 17th, 19th, 21st, 24th to 28th. The highest velocities recorded were as follows: 76, nw., 17th; 76, w., 21st; 96, w., 25th (maximum for the month); 74, w., 28th.

At Cape Mendocino, California, the highest velocities were: 64, se., 2d; 50, se., 23d; 60, se., 24th; 54, se., 26th; 72, se., 27th (maximum for the month).

Other stations reporting wind-velocities of fifty miles or more per hour, are as follows:

Fort Custer, Montana, 72, nw., 17th, and 72, w., 25th.
Cape May, New Jersey, 61, w., 28th.
Barnegat City, New Jersey, 59, nw., 28th.
Moorhead, Minnesota, 56, nw., 7th.
Fort Canby, Washington Territory, 56, s., 26th.
Sandusky, Ohio, 56, nw., 18th.
Sandy Hook, New Jersey, 56, nw., 28th.
Block Island, Rhode Island, 55, nw., 28th.
Cheyenne, Wyoming, 52, nw., 17th.
Fort Shaw, Montana, 52, sw., 27th.
Chincoteague, Virginia, 50, nw., 28th.

LOCAL STORMS.

Key West, Florida, 15th.—During a gale ("norther") the s. s. "Alarm" was blown against the Government wharf and had a hole stove in her side.

Idaho Springs, Clear Creek county, Colorado, 17th.—A violent storm prevailed in the morning. Several small houses were blown down, resulting in damage estimated at $5,000.

Fort Collins, Larimer county, Colorado.—A very destructive storm passed over this part of the state on the 17th. About a dozen residences at this place were more or less injured. The damage resulting from the storm in Larimer county is estimated at $10,000.

Ashland, Jackson county, Oregon.—On the night of the 23–24th, in mountains between this place and Linkville, Lake county, one of the severest storms occurred that has been experienced for many years. About thirty miles of the government telegraph line were prostrated.

Dr. G. G. Whitcomb, of Ogreeta, Cherokee county, North Carolina, reports that at 8.30 p. m. of the 24th a violent storm occurred five miles north of that place, passing over the tops of the mountains at an elevation of 2,300 feet. The cloud was funnel-shaped and passed from west-northwest eastwardly. Hail, sleet, and snow followed after the storm had passed, or seemed to be thrown from it. As the country over which it passed is sparsely settled but little damage was done, other than that sustained by the forests. The movement of the clouds toward the path of the storm was observed at a distance of three miles.

New Haven, Connecticut.—During the night of the 24–25th the brig "Ellen Maria" was blown ashore on Fisher's island. She was valued at $10,000, and proved almost a total loss. The schooner, "Laura" went ashore at Millstone point on the morning of the 25th; she was hauled off by the wreckers, having sustained damage to the extent of $800.

Fort Klamath, Lake county, Oregon.—A violent southwesterly wind and rain storm passed over that place on the afternoon of the 25th, uprooting trees and blowing down several miles of telegraph line.

Savannah, Georgia.—A violent thunder-storm occurred here during the early morning of the 27th. It approached this city from the west, following the course of the Savannah river. At 4 a. m. the city was aroused by the most unusual and violent

detonations. They were preceded by very vivid flashes of lightning of various colors, the interval between the flashes and the report being almost imperceptible. For about one hour and forty-five minutes (during which time no rain fell) the reports continued in rapid succession. At 5.45 a.m. it began to rain and the electrical disturbances ceased. Heavy showers of rain continued at intervals until 12.15 p. m., when it cleared off, the rainfall amounting to 1.26 inches. No damage resulted from the storm in this vicinity. For several days preceding the storm the atmosphere was noticeable for its unusual sultriness, and at 2 a. m. of the 27th the sky was overspread with a thin film, forming faint halos around the more brilliant stars. The thickness of the clouds rendered it intensely dark for an hour after the time for daylight.

New York City.—During the storm of the 28th numerous signs and chimneys were blown down, and vessels in the harbor dragged anchor. Other slight damage was reported from surrounding localities.

Pittsfield, Berkshire county, Massachusetts.—A violent westerly gale prevailed here on the 28th. Many trees and chimneys were blown down, and the roofs of several buildings were blown off. Buildings were also damaged at East Douglass and Milford, in Worcester county.

Sandy Hook, New Jersey.—The schooner "Kate E. Gilford" was blown ashore at 4 a. m. of the 28th; she was hauled off on the 30th, having sustained but slight injury.

Narragansett Pier, Rhode Island.—The schooner "Belle O'Neal" was driven ashore one mile north of Whole Rock light-house during a westerly gale at 4 a. m. of the 27th; she was hauled off at 8 p. m. of the same date, being damaged to the extent of $300.

NAVIGATION.

STAGE OF WATER IN RIVERS.

The Ohio river at Pittsburg, Pennsylvania, rose eleven feet and eight inches during the forty-eight hours ending at 2 p. m. on the 25th, and on that date reached its highest stage—eighteen feet and nine inches above low-water mark—or within one foot and three inches of the danger-line. It fell rapidly during the 26th and 27th, and, on the 31st it had fallen to six feet and four inches. The lowest stage of the month, two feet and ten inches, occurred on the 10th.

At Cincinnati, Ohio, the Ohio river rose seventeen feet and nine inches during the twenty-four hours ending at 2 p. m. of the 24th, and during the succeeding twenty-four hours it rose nine feet and four inches; it continued to rise until the 28th, on which date it reached a height of forty-nine feet and six inches above low-water mark, or within six inches of the danger-line. By 2 p. m. of the 29th it had fallen two feet below the highest point reached, and continued falling uninterruptedly until the close of the month, when it was eight feet below the highest point reached on the 28th. The lowest stage recorded during the month, ten feet and one inch, occurred on the 13th.

At Louisville, Kentucky, the Ohio rose steadily from the 24th to the 29th, reaching a point nine inches above the danger-line on the latter date; it was lowest, and stationary, from the 13th to 15th.

The Mississippi river at Saint Paul, Minnesota, was frozen from the 1st to the 10th, and from the 14th to the 31st; at La Crosse, Wisconsin, from the 16th to the 31st, and at Dubuque, Iowa, from the 18th to 31st. On the 26th an ice-dam formed in the river above Keokuk, Iowa, causing the water at that place to fall below low-water mark of 1864. The highest water at Keokuk, Iowa, five feet and nine inches, occurred on the 30th. At Saint Louis, Missouri, the highest water occurred on the 1st; at Cairo, Illinois, and Memphis, Tennessee, on the 31st; at Vicksburg, Mississippi, on the 8th and 9th; and at New Orleans, Louisiana, on the 11th and 12th. The Mississippi reached its lowest stage, at all stations between Keokuk and New Orleans, from the 21st to 31st.

The Missouri river continued low throughout the month. At Yankton, Dakota, it was frozen from the 16th to the 31st, and at Omaha, Nebraska, on the 30th and 31st.

The greatest ranges occurring in any of the rivers during the month are thirty-five feet and nine inches in the Ohio at Cincinnati, Ohio: twenty-seven feet and eleven inches in the Cumberland at Nashville, Tennessee; twenty feet and seven inches in the Mississippi at Cairo, Illinois; eighteen feet and eleven inches in the Ohio at Louisville, Kentucky.

In the following table are shown the danger-points at various river stations; the highest and lowest stages for December, 1883, with the dates of occurrence; and the monthly ranges:

Heights of rivers above low-water mark, December, 1883.

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
Red River:	Ft. In.		Ft. In.		Ft. In.	Ft. In.
Shreveport, Louisiana	29 9	25	14 2	6	8 1	6 1
Arkansas:						
Little Rock, Arkansas	33 0	9	17 6	29	5 7	11 11
Fort Smith, Arkansas	.....	7	5 8	31	—2 0	10 11
Missouri:						
Yankton, Dakota †	20 0	15	1 5	1 to 5 9 to 14	0 9	6 0
Omaha, Nebraska †	16 0	29	5 1	20	2 10	2 3
Leavenworth, Kansas	21 0	15, 10	5 2	26	2 3	2 11
Mississippi:						
Saint Paul, Minnesota †	14 6	12	2 7	11, 13	2 6	0 1
La Crosse, Wisconsin †	18 0	9, 10	2 0	1, 2, 3	1 2	0 10
Dubuque, Iowa †	21 10	10	4 7	5, 6	3 0	1 7
Davenport, Iowa	15 0	14, 15	3 2	6	2 1	1 1
Keokuk, Iowa ‡	14 6	30	5 9	21	—0 6	6 5
Saint Louis, Missouri	30 0	1	10 5	29	4 6	5 11
Cairo, Illinois	40 0	31	33 9	22	13 2	20 7
Memphis, Tennessee	34 0	31	23 2	23	8 9	14 5
Vicksburg, Mississippi	41 0	8, 9	29 9	29	18 6	11 3
New Orleans, Louisiana *	—2 6	11, 12	— 7 0	31	—10 5	3 5
Ohio:						
Pittsburg, Pennsylvania	20 0	25	18 9	8	2 10	15 11
Cincinnati, Ohio	50 0	28	49 0	13	10 1	39 5
Louisville, Kentucky	24 0	29	24 9	13, 14, 15	5 10	18 11
Cumberland:						
Nashville, Tennessee	42 0	28	33 9	7	5 10	27 11
Tennessee:						
Chattanooga, Tennessee	33 0	28	13 0	7, 8	3 6	10 6
Monongahela:						
Pittsburg, Pennsylvania	29 0	25	18 9	8	2 10	15 11
Savannah:						
Augusta, Georgia	30 0	10	9 2	8, 9	5 0	4 2
Willamette:						
Portland, Oregon	.....	29	10 8	24	1 5	9 3
Sacramento:						
Red Bluff, California	.....	26	3 0	1 to 24	0 10	2 2
Sacramento, California	.....	29	9 10	18 to 23	7 0	2 10
Mobile:						
Mobile, Alabama	.....	7	15 8	15	12 0	3 8
Colorado:						
Yuma, Arizona	.....	.....	.....	.....	.....	.....

* Below high-water marks of 1874 and 1883. ‡ On 22d, below any mark on gauge. † Observations interrupted by ice; see text.

ICE IN RIVERS AND HARBORS.

Penobscot river.—Bangor, Maine: navigation closed on the 16th; the "Katahdin" was the last steamer to leave this port.

Kennebec river.—Gardiner, Maine: the river froze over on the 23d.

Lake Whitney.—New Haven, Connecticut: the lake froze over on the 16th.

Hudson river.—Albany, New York: the river froze over at this place on the 16th. The last steamer to leave here was the "Drew"; and the steamer "Ellen M. Rovan" was the last boat to arrive, having forced her way through the ice on the 17th. On the 22d, the river was filled with ice from Rhinebeck southward to Poughkeepsie, and navigation north of the latter city was practically closed, although the main channel remained open from Poughkeepsie to Roundout. North of Roundout the river was closed. North of Catskill the ferry boats ceased running, and people crossed on the ice on that date. From Poughkeepsie southward the river was almost entirely free of ice, none being visible except in the vicinity of Poughkeepsie. North of Hudson the ice was five inches thick.

New York City: floating ice was observed in the river on the 21st and 24th.

Lake Ontario.—Oswego, New York: the steam barge "Saxon" left port on the 11th, being the last departure of the season. On the 22d the Oswego river was frozen over from the head of the island to the lower bridge.

Niagara river.—Buffalo, New York: the river froze over on the 24th.

Erie bay.—Erie, Pennsylvania: the bay was closed by ice during the night of the 20–21st.

Cuyahoga river.—Cleveland, Ohio: the river froze over during the night of the 16–17th.

Sandusky bay.—Sandusky, Ohio: all steamers except the "American Eagle" went into winter quarters on the 15th; navigation practically closed for the season.

Maumee river.—Toledo, Ohio: the river closed on the 17th.

Detroit river.—Detroit, Michigan: floating ice was observed in the river on the 20th and 21st.

Saint Clair and Black rivers.—Port Huron, Michigan: the Black river froze over on the 18th; floating ice in Saint Clair river on the 22d.

Thunder bay and Thunder Bay river.—Alpena, Michigan: floating ice in river and bay on the 14th; river partly frozen on 15th; bay partly frozen on 17th; navigation closed on 19th.

Saint Mary's river.—Fort Brady, Michigan: teams crossed the river on the ice from the 22d to the close of the month.

Straits of Mackinac.—Mackinaw City, Michigan: ice formed along the shores on the 14th; on the 18th the straits were covered with thin ice.

Lake Superior.—Duluth Minnesota: on the 17th the lake was frozen for a distance of three miles from the shores; on the 28th it was filled with floating ice as far as the eye could reach.

Marquette, Michigan: the steamer "Samuel Hodge" left port on the 3d, for the lower lakes, being the last departure of the season.

Lake Michigan.—Milwaukee, Wisconsin: ice formed along the shores of the lake on the 17th.

Chicago, Illinois: navigation was practically closed on the 15th.

Grand river.—Grand Haven, Michigan: drift ice was observed in the river on the 19th; on the 22d the river froze over, but the ice broke up on the 24th.

Lansing, Michigan: the river closed on the 16th.

Mississippi river.—Saint Paul, Minnesota: the river was frozen from the 1st to the 31st; on the 11th the ice melted around the harbor and near the river gauge, so that observations were made for a few days, but the harbor froze over again on the 14th.

La Crosse, Wisconsin: the river froze over on the 18th, and remained so after that date.

Dubuque, Iowa: floating ice on the 1st, 3d, 4th, 5th, and 17th; river froze over on the 19th; teams crossed on the ice on the 20th.

Davenport, Iowa: the last steamer of the season left this place on the 2d; floating ice was observed from the 3d to 18th; on the 24th the river was frozen solidly and teams crossed on the ice.

Muscatine, Iowa: the river froze over on the 19th; on the 21st teams crossed on the ice.

Burlington, Iowa: floating ice on the 15th; river closed on the 18th.

Keokuk, Iowa: navigation closed for the season on the 14th; ice-dams formed above the city on the 19th and 21st, causing the water to fall below the low-water mark of 1864 on the latter date.

Saint Louis: the first floating ice was observed on the 18th; on that date navigation was practically suspended for the season; floating ice continued until the 26th, when the river was nearly free of ice; light floating ice was observed on the Illinois side on the 27th, 28th, and 29th; on the 30th and 31st the river was clear of ice.

Cairo, Illinois: navigation between this city and Saint Louis closed on the 30th.

Des Moines river.—Des Moines, Iowa: the river froze over on the 18th.

Missouri river.—Yankton, Dakota: an ice-dam formed in the river on the 15th; the river remained frozen after the 16th.

Vermillion, Dakota: the river closed on the 17th.

Omaha, Nebraska: the river froze over on the 30th.

Rock river.—Rockford, Illinois: the river froze over on the 16th.

Ohio river.—Cincinnati, Ohio: much floating ice was observed on the 24th.

Tuscarawas river.—Canal Dover, Ohio: the river froze over on the 13th, but was again clear of ice on the 25th.

At Wellsborough, Tioga county, Pennsylvania, on the 30th, ice was reported to be about five inches thick.

FLOODS.

Galveston, Texas, 6th.—Reports from Dallas stated that that city was partly flooded by a heavy rain storm which occurred during the night of the 5–6th. A large amount of damage was done to buildings, sewers, etc. The streams in the surrounding country were much swollen, flooding the railroad tracks and delaying trains from six to eight hours.

Cincinnati, Ohio.—On the 24th the Licking river, which empties into the Ohio opposite this city, rose twenty-six feet. Many barges and other river craft were broken from their moorings and swept away by the strong current. Very heavy losses were sustained by the owners of barges, etc. The Ohio river reached its highest point on the morning of the 28th, when all the buildings nearest the river between Main street and the suspension bridge, and between Broadway and Ludlow street, were flooded.

Laconia, Harrison county, Indiana, 24th.—The Ohio river has risen about twenty feet opposite this place during the last forty-eight hours.

Vevay, Switzerland county, Indiana.—On the 24th cellars, culverts, etc., at this place were flooded and much damage was done. The Ohio river rose nearly to the top of its banks on that date, and an inundation was threatened.

Wickenburg, Arizona.—The heavy rains of the 21st and 22d caused Hassayampa creek (which in this vicinity, has been completely dry for several months) to rise to such an extent that it could not be forded. It continued high during the 23d, but it fell rapidly on the following day.

Plymouth, Grafton county, New Hampshire.—The village reservoir, having an elevation of nearly two hundred feet, was washed out during the night of the 27–28th, owing to the heavy rains which melted the snow, and caused an overflow.

HIGH TIDES.

Eastport Maine, 13th, 14th.

LOW TIDES.

New York City.—The westerly gale of the 28th caused a very low tide about the shores of Staten Island. For the second time during the past year Split Rock, off Tompkinsville, was above the water line. This rock is generally seen about once in seven years. New Creek shoals, the beach at Great Kills, and Old Orchard shoals were uncovered for several miles. The "middle grounds" off Seguine's Point were nearly dry, which is an unusual occurrence. The Staten Island ferry-boats experienced difficulty in making their landings.

Low tides also occurred at New London, Connecticut, on the 28th, and at Cedar Keys, Florida, on the 15th, 16th and 17th.

VERIFICATIONS.

INDICATIONS.

The detailed comparison of the tri-daily indications for December, 1883, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 84.90 per cent. The percentages for the four elements are: weather, 87.32; direction of the wind, 82.20; temperature, 85.09; barometer, 84.80 per cent. By geographical districts they are: for New England, 85.20; middle Atlantic states, 86.69; south Atlantic states, 82.57; eastern Gulf, 83.60; western Gulf, 85.65; lower lakes, 86.38; upper lakes, 86.04; Ohio valley and Tennessee, 84.44; upper Mississippi valley, 84.00; Missouri valley, 83.38; north Pacific, 89.77; middle Pacific, 87.00; south Pacific, 93.20.

There were forty-nine omissions to predict out of 3,813, or 1.29 per cent. Of the 3,764 predictions that have been made, one hundred and twenty-nine, or 3.43 per cent., are considered to have entirely failed; one hundred and thirty-one, or 3.48 per cent., were one-fourth verified; four hundred and forty-seven, or 11.88 per cent. were one-half verified; four hundred and seventy-one, or 12.51 per cent., were three-fourths verified; 2,586, or 68.70 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

CAUTIONARY SIGNALS.

During December, 1883, two hundred and eight cautionary signals were displayed. Of these, one hundred and eighty-six, or 89.4 per cent., were justified by winds of twenty-five miles, or more, per hour, at or within one hundred miles of the station. Sixty-six cautionary off-shore signals were displayed, of which number sixty, or 90.9 per cent., were justified both as to direction and velocity; and sixty-one, or 92.4 per cent., were justified as to direction. There were no "northwest" signals ordered on the lakes during the month. Two hundred and seventy-four signals of all kinds were displayed, of which two hundred and forty-six, or 89.8 per cent., were fully justified. These do not include signals ordered at display stations where the velocity is only estimated. Six signals were ordered late. Of the sixty-six cautionary off-shore signals that were displayed, twenty-five were changed from cautionary signals.

Seventy-nine cases have been reported from the various signal stations in which the maximum hourly velocity of the wind reached twenty-five or more miles, and for which signals had not been ordered to be displayed. These were from scattered stations as a rule, and it is not believed that any damage resulted from dangerous winds, as generally fair weather prevailed. On the 1st signals were ordered up for all lake stations excepting Duluth, Marquette, and Escanaba; subsequent changes proved that signals should have been hoisted at those stations also, as high northwesterly winds prevailed over that region on the 1st and 2d in the western quadrants of low area i., but with generally fair weather. At Buffalo and Rochester the signals were lowered too soon on the 8th. High westerly winds occurred on Lakes Michigan and Huron, night of the 9th, and 10th, during the progress of low area v., for which signals had not been ordered, but fair weather was general; the lower lake stations were warned, morning of the 10th. High northeasterly winds, with rain, were reported from the central portion of the North Carolina coast on the 9th, for which signals should have been displayed. The "norther," for which off-shore signals were displayed on the Texas coast on the 13th, 14th, and 15th, extended eastward across the Gulf; if signals had been displayed at New Orleans and Cedar Keys they would have been justified, as velocities of n. 28 and nw. 29 miles, respectively, were registered. On the 14th signals were ordered up along the coast from Maine to Cape Hatteras, in advance of low area vii., but high westerly winds also occurred along the southern portion of the North Carolina coast. For the storm, low area xii., which appeared off the middle Atlantic coast on the 21st, no signals were ordered, and high northeast backing to northwest winds were produced along the New Jersey and New England coasts. At midnight of the 24th, after low area xiv. had passed northeastward along the New England coast, the signals were lowered, but subsequent reports proved that at Block Island and the New Jersey coast stations they should have been retained twenty-four hours longer.

Professor T. C. Mendenhall, director of the Ohio Meterological Bureau, in his report for December, 1883, says:

> It is found, from special reports made to the bureau, that the percentage of verifications of the railway train weather signals was eighty-six per cent. for the month of December.

These signals consist of colored symbols, displayed from the sides of the baggage cars of the Cleveland, Akron, and Columbus railroad company, representing the daily forecasts, as telegraphed from the Office of the Chief Signal Officer to said bureau.

TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors at the Signal Service stations during December, 1883, with the average depth at which the observations were made, and the mean temperature of the air at the several stations, are shown in the following table. On account of ice-formation observations were not made at the following stations on the dates named: Alpena, Michigan, from 16th to 31st; Mackinaw City, Michigan, on the 14th and 15th, and from 17th to 31st; Escanaba, Michigan, on the 15th, 16th, and 17th, and from 19th to 31st; at Chicago, Illinois, Duluth, Minnesota, Marquette, Michigan, Milwaukee, Wisconsin, and Toledo, Ohio, from 17th to 31st; Sandusky, Ohio, from 16th to 31st; Detroit, Michigan, from 22d to 31st; Grand Haven, Michigan, on 22d and 23d; Buffalo, New York, on 23d, 24th, 25th, 29th, 30th, 31st; Boston, Massachusetts, 23d. The highest temperatures observed during the month are reported from Key West, Florida, (76°.9 on the 28th); Cedar Keys, Florida, (74° on 7th); and Galveston, Texas, (69° on 23d). The largest monthly ranges are: 34°.1 at Cedar Keys, Florida; 24°.6 at Toledo, Ohio, (record from 1st to 16th); 19° at Galveston. The smallest monthly ranges are: 2°.3 at San Francisco, California; 5°.4 at Portland, Oregon; 5°.7 at Savannah, Georgia.

Temperature of water for December, 1883.

STATION.	Temperature at bottom.		Range.	Average depth, feet and inches.	Mean temperature of the air at station.
	Max.	Min.			
	°	°	°	ft. in.	°
Atlantic City, New Jersey	47.1	35.6	11.5	5 11	37.2
Alpena, Michigan*	34.7	30.5	4.2	11 9	23.3
Augusta, Georgia	56.0	46.0	10.0	6 2	53.2
Baltimore, Maryland	45.0	35.0	10.0	9 10	39.0
Block Island, Rhode Island	47.2	30.8	16.4	8 3	35.0
Boston, Massachusetts *	41.0	29.5	11.5	22 5	28.7
Buffalo, New York *	40.2	32.2	8.0	10 0	34.0
Cedar Keys, Florida	74.2	40.1	34.1	11 7	67.1
Charleston, South Carolina	58.7	51.9	6.8	40 1	56.0
Chicago, Illinois *	38.9	34.3	4.6	8 1	30.1
Chincoteague, Virginia	49.0	32.5	16.5	5 0	40.9
Cleveland, Ohio	41.2	32.0	9.2	14 0	32.2
Detroit, Michigan*	39.2	33.0	6.2	22 2	33.5
Delaware Breakwater, Delaware	48.2	37.8	10.4	7 7	39.5
Duluth, Minnesota *	36.6	35.1	1.5	14 10	15.7
Eastport, Maine	43.7	37.5	6.2	16 2	23.4
Escanaba, Michigan*	38.5	31.5	7.0	15 0	20.1
Fort Canby, Washington Territory	47.0	37.2	9.8	17 6	44.2
Fort Macon, North Carolina	58.7	49.0	9.7	2 11	50.0
Galveston, Texas	69.0	50.0	19.0	10 7	60.2
Grand Haven, Michigan *	37.8	31.6	6.2	19 0	30.6
Indianola, Texas	67.7	50.0	17.7	8 0	59.5
Jacksonville, Florida	65.0	56.0	9.0	18 0	60.5
Key West, Florida	76.9	71.0	5.9	17 8	71.5
Mackinaw City, Michigan *	38.5	31.6	6.9	10 0	24.9
Marquette, Michigan *	36.0	34.0	2.0	9 10	21 1
Milwaukee, Wisconsin *.	37.5	34.5	3.0	8 0	26.4
Mobile, Alabama	62.0	53.0	9.0	14 4	56.4
New Haven, Connecticut	40.3	31.2	9.1	15 6	29.7
New London, Connecticut	46.0	38.0	8.0	12 7	31.5
New York City	44.0	31.3	12.7	10 4	33.7
Norfolk, Virginia	49.5	42.0	7.5	16 7	46.4
Pensacola, Florida	63.9	56.6	7.3	16 8	57 9
Portland, Maine	40.0	30.5	9.5	14 10	27.7
Portland, Oregon	46.1	40.7	5.4	56 5	41.8
Provincetown, Massachusetts	43.8	29.3	14.5	11 1	32.9
Sandusky, Ohio*	40.5	35.0	5.5	9 8	33.3
Sandy Hook, New Jersey	45.0	35.8	9.2	1 6	35.4
San Francisco, California	52.1	49.8	2.3	39 8	50.2
Savannah, Georgia	57.0	51.3	5.7	11 9	57.1
Smithville, North Carolina	64.5	50.2	14.3	10 0	51.7
Toledo, Ohio*	58.9	34.3	24.6	10 6	32.7
Wilmington, North Carolina	54.0	47.0	7.0	20 10	52.8

*Observations interrupted by ice; see text.

ATMOSPHERIC ELECTRICITY.

AURORAS.

There were no unusually brilliant or widely-extended auroral displays observed in the United States during December. The most noteworthy display of the month occurred on the night of the 1st. This display was noted by scattering observers from eastern New England to northwestern Dakota, the most numerous reports coming from the upper lake region. The following notes relating to this display have been received:

Eastport, Maine, 1st.—A faint auroral arch was observed from 6.40 to 7.40 p. m.

Gardiner, Maine, 1st.—A brilliant auroral light, extending from northwest to northeast, was observed at 6 p. m.

Voluntown, Connecticut, 1st.—A faint auroral light was visible during the evening.

Erie, Pennsylvania.—An auroral light of moderate brilliancy was visible from 12.20 to 2 a. m. of the 2d.

Cleveland, Ohio, 1st.—An auroral light was visible until midnight, the light extending from northwest to east.

Grand Haven, Michigan.—A faint auroral display was noted from 9 p. m. of the 1st to 2 a. m. of the 2d.

Escanaba, Michigan, 1st.—A diffuse auroral light was observed from 7.25 to 9.58 p. m.

Fort Buford, Dakota, 1st.—An auroral arch of pale white formed at 8 p. m., having an altitude of 40°, and extending from northwest to northeast. The display disappeared at 11.18 p. m.

The following stations also report the display of the 1st, the description given being similar to those published above: Bangor and Cornish, Maine; Fall River, Massachusetts; Escanaba, Michigan; Riley, Illinois; Cresco, Humboldt, and Monticello, Iowa; Manitowoc, Wisconsin; Moorhead and Saint Vincent, Minnesota; Fort Totten and Webster, Dakota; Madison and Sussex, Wisconsin.

Other displays occurred as follows:

On the summit of Mount Washington a faint aurora was observed during the early morning of the 1st.

Moorhead, Minnesota, 2d.—An auroral light, extending from the magnetic meridian to points 15° east and west, was observed at 9 p. m. It consisted of a straw-colored arch from which occasional beams extended upward. The display ended at 11 p. m. An auroral display was also observed on that date at Humboldt, Iowa.

Manitowoc, Wisconsin, 5th.—An aurora was observed at 5.30 p. m., appearing as a bright red spot in the northeastern sky, at an altitude of 15°.

Saint Vincent, Minnesota, 10th.—From 6 p. m. until daylight a faint auroral arch was observed in the north.

Clear Creek, Nebraska, 19th.—Bright auroral streamers were observed at 7.30 p. m.

Fort Totten, Dakota, 24th.—An aurora was visible in the northern sky from 8 to 11.30 p. m. The light was of a pale straw color, the upper limit being well-defined. A complete arch was formed, beneath which appeared a dark segment.

Escanaba, Michigan, 27th.—A faint aurora consisting of two straight bands of straw-colored light, with a dark base, was observed from 9.45 to 11.20 p. m.

Washington City, District of Columbia, 28th.—At 9 p. m. an aurora was observed, consisting of a narrow band of pale yellow light extending across the northwestern sky, and forming an imperfect arch, beneath which was the usual dark base.

Saint Vincent, Minnesota, 28th.—An auroral arch was observed from 5.30 a. m. until daylight.

THUNDER-STORMS.

Thunder-storms were reported from the various states and territories as follows:

Alabama.—Auburn, 24th.

Arizona.—At numerous stations on the 4th, and at Prescott on the 3d.

Arkansas.—Mount Ida, 5th, 6th, 13th; Fort Smith, 5th, 23d; Little Rock, 23d.

California.—Cape Mendocino, 23d.

Connecticut.—Of general occurrence on the 27th.

Florida.—Jacksonville, 3d; Newport, 14th, 25th, 27th; Pensacola, 24th, 26th; Limona, 27th; Archer, 27th; Cedar Keys, 31st.

Georgia.—Andersonville, 26th; Savannah, 27th.

Illinois.—Cairo, 23d; Springfield, 23d; Anna, 23d, 31st.

Indiana.—Rising Sun, 9th, 21st, 26th.

Iowa.—Humboldt, 6th.

Kansas.—Allison, 5th; Fort Scott, 5th; Indipendence, 5th; Wellington, 5th, 22d.

Kentucky.—Louisville, 31st.

Louisiana.—New Orleans, 7th; Grand Coteau, 7th, 30th; Liberty Hill, 6th, 24th, 29th, 30th.

Maine.—Gardiner, 7th; Portland, 7th.

Massachusetts.—Of general occurrence throughout the state on the 27th, and at Charlestown on the 20th; Cambridge, 28th.

Mississippi.—Vicksburg, 7th, 29th, 30th, 31st.

Nebraska.—De Soto, 6th; Genoa, 6th.

New Jersey.—Cape May, 2d; Moorestown, 29th; Sandy Hook, 27th; Vineland, 27th.

New York.—Flushing, 27th; New York City, 27th.

North Carolina.—Kitty Hawk, 1st, 2d, 5th, 26th; Weldon, 2d, 27th; Ogreeta, 24th; Smithville, 25th, 27th; New River Inlet, 26th; Fort Macon, 27th.

Pennsylvania.—Fallsington, 27th.

Rhode Island.—Block Island, 27th; Narragansett Pier, 27th; Point Judith, 27th.

South Carolina.—Charleston, 27th.

Tennessee.—Memphis, 7th, 23d, 24th; Ashwood, 23d; Nashville, 23d, 24th; Milan, 30th.

Texas.—Cleburne, 5th; Fort Concho, 5th, 6th; Barnesville, 5th, 26th, 30th; Galveston, 6th, 24th, 26th, 29th; Indianola, 6th, 26th, 29th.

Vermont.—Dorset, 9th, 27th.

OPTICAL PHENOMENA.

SOLAR HALOS.

Solar halos have been observed in the various districts on the following dates:

New England.—11th, 23d, 24th, 26th.

Middle Atlantic states.—3d, 13th, 14th, 23d, 29th, 30th.

South Atlantic states.—4th, 7th, 10th, 11th, 18th.

Eastern Gulf states.—4th, 8th to 11th, 13th.

Ohio valley.—6th, 12th, 29th.

Lower lakes.—1st, 7th, 12th, 13th, 17th, 19th, 20th, 26th, 29th.

Upper lakes.—3d, 13th, 15th, 16th, 17th, 19th, 20th, 26th.

Extreme northwest.—10th, 17th, 18th, 24th, 25th, 31st.

Upper Mississippi valley.—3d, 9th, 10th, 12th, 13th, 16th to 20th, 26th, 29th.

Missouri valley.—11th, 19th, 20th, 26th, 31st.

Solar halos were also observed at the following stations not situated in the districts named above:

Arkansas.—Lead Hill, 2d, 5th, 10th, 11th, 12th; Little Rock, 11th.

California.—San Francisco, 1st, 8th, 10th, 19th, 23d, 31st.

Florida.—Archer, 5th, 8th; Jacksonville, 5th.

Kansas.—Salina, 10th.

Oregon.—Roseburg, 8th.

Tennessee.—Chattanooga, 6th; Milan, 28th.

Washington Territory.—Bainbridge island, 10th.

Wyoming.—Fort Bridger, 2d.

LUNAR HALOS.

Lunar halos have been observed in the various districts on the following dates:

New England.—7th, 9th to 13th, 16th, 19th.

Middle Atlantic states.—4th, 6th, 7th, 8th, 12th to 15th, 17th.

South Atlantic states.—4th, 6th to 11th, 13th, 17th.

Florida peninsula.—7th to 10th, 13th, 18th.

Eastern Gulf states.—5th to 13th.

Western Gulf states.—6th to 16th.

Tennessee.—6th to 13th, 17th.

Ohio valley.—6th, 10th, 12th.

Lower lakes.—6th, 10th, 13th, 16th, 17th, 20th.

Upper lakes.—3d, 4th, 6th, 8th to 17th, 19th, 20th.

Extreme northwest.—5th, 8th, 10th.

Upper Mississippi valley.—5th, 8th, 10th, 12th, 15th, 17th.

Missouri valley.—4th, 9th to 12th, 15th, 17th to 20th.

Middle slope.—10th to 13th, 15th.

Southern plateau.—5th, 15th, 18th.

Northern plateau.—7th to 10th.

North Pacific coast.—8th to 12th.

Middle Pacific coast.—4th, 8th, 10th, 14th, 19th.

Lunar halos were also reported from the following stations not situated in the districts named above:

California.—Poway, Los Angeles and San Diego, 8th.
Nebraska.—North Platte, 12th.
Nevada.—Carson City, 1st, 8th.
Texas.—Fort Stockton, 21st.
Utah.—Salt Lake City, 7th, 16th.

MIRAGE.

Toledo, Ohio.—On the morning of the 6th the river presented a beautiful appearance from the effects of a distinct mirage. The Wheeling and Lake Erie railroad bridge loomed up through the mist in large proportions; and while it is two miles distant it did not appear to be more than one-half mile. The hulls of two vessels lying behind the Ohio Central wharf, on the east side of the river, were seen from this side of the river as though no object intervened.

Webster, Day county, Dakota.—At sunrise on the morning of the 11th a beautiful mirage was observed. The distant hills and other objects, ordinarily invisible, were apparently lifted into the range of vision, and the sun appeared in five pieces. The phenomenon lasted two hours.

Huron, Dakota.—A remarkably fine mirage was observed here between 8 and 9.30 a. m. of the 25th. The Wessington hills, thirty miles southwest of here, appeared to be only about three or four miles distant, presenting a palisade-like front several feet in height. The town of Wessington Springs, on the eastern slope of the hills, was clearly outlined. Houses and barns many miles away, and not ordinarily visible with the aid of a glass, were plainly seen, a number appearing in inverted positions.

MISCELLANEOUS PHENOMENA.

In the REVIEW for November, 1883, under the heading "miscellaneous phenomena," was published a summary of the reports received from the regular and voluntary observers of the Signal Service, relating to the unusual phenomenon, at sunrise and sunset, which has been so extensively observed in this and other countries. These remarkable sunsets were reported by observers during the preceding months, but owing to the limited number of observers reporting them their reports were not considered of sufficient importance to publish. In this REVIEW will be found the reports received during the previous months. They are as follows:

Alabama.—Montgomery, October 14th: the western sky presented a very peculiar appearance at sunset.

Arizona.—Fort Grant, October 23d: the sunset of this date was peculiar and beautiful; the western sky was filled with well-defined cirro-stratus clouds; at sunset these clouds were brilliantly illuminated, presenting a variety of color rarely seen.

Yuma, October 19th: for one and one-half hours after sunset the western sky was of a rich, blood-red color, which gradually faded away. The same appearances were noted on October 20th and 21st.

California.—Cape Mendocino, August 23d: a red sunset, preceded by unusual peculiarities of cloudiness, was observed here on this date.

San Diego, October 30th: a brilliant reflection in the western sky was visible for some time after sunset.

Florida.—Pensacola, October 8th: at sunset the sky was of a brilliant, luminous red, resembling the reflection from a vast fire, lasting for a considerable time after sunset. On October 9th, preceding sunrise, the sky was of a bright red color, reaching an altitude of about 30°.

Georgia.—Atlanta, October 30th: at sunset the whole heavens were of a dull, reddish hue. A peculiar, yellowish sunset was observed on October 31st.

Indiana.—Logansport: a yellow sunset, with a peculiar band of light of the same color, changing to dark red, was observed on August 13th.

Kansas.—Wellington, Sumner county, October 28th: a bright red sunset was observed.

Massachusetts.—Somerset, Bristol county: during September and October numerous beautiful autumnal sunsets were observed.

North Carolina.—Charlotte, October 30th: a brilliant sunset was observed, followed by an intensely red light, resembling the reflection from a vast fire.

South Carolina.—Stateburg, Sumter county: brilliant, red sunsets were observed on October 30th and 31st.

Tennessee.—Memphis: brilliant, rosy sunsets were observed on October 29th, 30th, and 31st; they were at first thought to be the reflection from a large fire.

Nashville, August 22d: a beautiful sunset was noted. On September 5th and 6th the sunset shadows were very bright. On October 7th they were again very bright and distinct. The sunset of October 29th was unusually brilliant, being of a bright red color, which remained visible until 6.40 p. m. A similar sunset was also observed on the 30th.

Virginia.—Lynchburg: shortly after sunset on October 30th and 31st the western sky presented a hazy and rose-tinted appearance, extending upward 45°, and resembling the zodiacal light.

The following reports relative to this phenomenon were received from the various states and territories for the month of December:

Alabama.—Auburn, Lee county, 1st: a remarkable sunset.

Arizona.—Fort Bowie: red sunsets on the 11th, 17th, and 27th.

Arkansas.—Fort Smith: at sunset of the 6th a peculiar, greenish tinge was noticeable in the western sky, gradually increasing in extent and changing to a deep red color. The illumination continued for one hour after sunset. Similar appearances were observed on the 7th, 8th, 14th, and 26th.

Fayetteville, Washington county, 31st: a remarkable redness of the sky, continuing for some time after sunset, was observed on almost every evening during the month.

California.—Princeton, Colusa county, 18th: the red sunsets prevailed during a part of the month and were exceedingly brilliant, the weather being entirely clear. A whitish light was also observed to precede the rising moon.

Hydesville, Humboldt county, 31st: December was characterized by red skies, which, during the latter part of the month, were observed both before sunrise and after sunset. These conditions were observed on the 1st, 2d, 4th, from 6th to 21st, and 31st. On the last date the display was very beautiful, the entire heavens having been covered with small cumulus and cumulo-stratus clouds, which were of bright orange colors, with a back-ground of deep blue.

Red Bluff, 31st: the month has been noted for its numerous brilliant sunsets.

Los Angeles: the sunsets of the 11th, 28th, and 29th were remarkably brilliant.

Cape Mendocino, 31st: many beautiful sunsets were observed here during the month; that occurring on the 18th being the most brilliant.

Central America.—The following extract is taken from a communication of Dr. Earl Flint, of date January 3, 1883, Rivas, Central America:

> I see no notice yet about the cause of the blue appearance of the sun—red in early morning. It was noticed in many parts of South America during the last of August and the fore part of September. It was different from that of the red light observed here late in November, attributed by Professor Brooks to meteoric showers.

Colorado.—Golden, Jefferson county: a deep crimson light was observed in the western sky in the evening from the 9th to 14th, 16th, 20th, 23d, 24th, 25th, 28th, 29th, 31st. On the last date the glow was very noticeable long after the sun's disappearance. From 5.15 to 5.25 p. m. this coloration extended over fully 80° of the sky, and the new moon, a faint crescent, appeared tinged with green.

Fort Collins, Larimer county: brilliant sunrises and sunsets were observed on the 4th, 10th, 25th, and 28th.

Connecticut.—Voluntown, New London county: a very brilliant sunset was observed on the 29th.

Dakota.—Webster, Day county, 31st: during the last eighteen days of the month the morning twilights were wonderfully bright, lighting the whole landscape with a fiery red color.

The evening twilights of the same dates were equally remarkable.

Vermillion, Clay county, 31st: the peculiar glow in the west after sunset has been very noticeable during December. On several evenings the light has been so bright as to cast decided shadows two hours after sunset.

Fort Yates: at sunset on the 1st the western horizon was beautifully illuminated as if by an extensive prairie fire. The same phenomenon was seen on the 2d and 4th.

Huron, Beadle County: a very red sunrise and sunset were observed on the 10th.

Delaware.—Saint George's, New Castle county, 31st: the red sky after sunset has been very noticeable during December. It was especially bright on the 29th. This peculiarity in the appearance of the sky has been observed at intervals since November 24th, the centre of the light not being at the point where the sun sets, but between the north and west.

Florida.—Archer, Alacahua county: a bright appearance of the eastern sky preceded the rising sun from one to two hours from the 1st to 7th, 11th, 29th, and 30th. On the evenings from the 17th to 23d and 27th the same peculiarities were observed in the western sky.

Mayport, Wakulla county: on the evening of the 28th the western sky was of a deep red color, which resembled the light from an extensive forest fire.

Georgia.—Andersonville, Sumter county: the sun at sunset on the evenings of the 4th and 5th was of a deep orange color. For an hour before sunrise on the 6th the eastern sky was of a brilliant orange color. At sunset of the 23d the sky was unusually brilliant in all directions, the light in the western sky extending almost to the zenith.

Quitman, Brooks county: on the evening of the 22d the after glow was very noticeable. An unusually bright light also preceded the rising sun.

Illinois.—Chicago: brilliant sunsets were observed on the 11th and 28th.

Swanwick, Perry county, 31st: the red sunrises and sunsets have been the most important feature of the month.

Peoria, Peoria county: on nearly every evening from the 14th to 25th the western sky was illuminated with a fiery red color.

Edgington, Rock Island county, 31st: during the past month the evening twilights were remarkable for their brilliancy.

Mattoon, Coles county: unusually bright twilights were frequently observed during December.

Collinsville, Madison county: the sunrises and sunsets on all days of the month were remarkable for their red appearance.

Indiana.—Sunman, Ripley county: brilliant sunset was observed on the 28th, the sunrise of the following morning being of a similar appearance.

Vevay, Switzerland county: brilliant, rosy sunrise and sunset were observed on the 28th.

Laconia, Harrison county, 31st: beautiful sunrises and sunsets were observed during the entire month.

Wabash, Wabash county: very bright sunsets were observed on the 9th, 10th, 11th, 12th, and 28th.

Iowa.—Keokuk, 9th: for several days past the sky has been remarkably red for one and one-half hours before sunrise and after sunset. Bright sunsets also occurred on the 24th, 25th, 27th, and 28th.

Oskaloosa, Mahaska county: red sunsets were observed on the 1st, 4th, 5th, and 11th.

Humboldt, Humboldt county: bright lights appeared in the western sky after sunset from the 24th to the 28th; on the mornings of the 27th and 28th the same light preceded sunrise.

Muscatine, Muscatine county: bright red sunrises and sunsets were observed on seventeen days during December.

Monticello, Jones county: the same bright appearance of the sky at sunset and sunrise that was seen during the latter part of November continued until the middle of December.

Kansas.—Leavenworth: brilliant sunsets occurred on the 3d, 4th, 7th, 8th, 9th, 24th.

Manhattan, Riley county: a bright appearance of the sky was observed before sunrise and after sunset of the 9th; the same phenomenon was also observed during the early morning of the 10th and on the evenings of the 26th and 27th.

Fort Scott, Bourbon county: unusually red sunrises and sunsets occurred on the 1st, from the 7th to 10th, 14th, 15th, 17th, 27th, and 28th.

Pretty Prairie, Reno county: a brilliant appearance of the western sky was noted on the 26th, 28th, and 29th.

Elk Falls, Elk county, 31st: the latter part of the month was characterized by remarkably red sunrises and sunsets.

Wellington, Sumner county: remarkable twilights were apparent on all clear and partly clear days of the month; they were noted on the 3d, 5th, 7th to 12th, 14th, 15th, 16th, and from 24th to 30th. The evening twilights were of a dark red color, and continued for one and one-half hours after sunset. In the mornings the colors were considerably lighter, but they appeared about the same length of time before sunrise. Those observed on the 27th and 28th were the most brilliant of the month.

Clay Centre, Clay county: for some time before sunrise on the 15th the sky presented a crimson appearance.

Topeka, Shawnee county, 31st: the red and orange tints which have been so noticeable for some time past, before sunrise and after sunset, were observed throughout December.

West Leavenworth: on every clear evening during December the sunsets were, without exception, tinted with a peculiar, golden glow. The same conditions were also observed at sunrise. These peculiarities were observed on twenty-one days during the month.

Maine.—Portland: a very peculiar, and most beautiful, sunset was observed on the 28th. It was similar in character to that observed on November 27th. The western horizon was of a dark crimson, shading off to a delicate rose-color at the zenith.

Eastport: a red glow in the western sky, lasting one hour after sunset, was observed on the 29th.

Maryland.—Woodstock, Harford county: before sunrise on the 2d a peculiar glow extended around the entire horizon and upward to a considerable height. A similar phenomenon was also observed on several days preceding that date.

Sandy Springs, Montgomery county, 31st: the peculiar, red light after sunset and before sunrise still continues.

Baltimore, 28th: the western sky was luridly ablaze from sunset (at 4.44 p. m.), until nearly 6.30 p. m.

Massachusetts.—Boston: at sunset of the 7th a peculiar glow was noticeable in the northwestern sky.

Taunton: the sunset of the 3d was very brilliant, but not so marked as that of November 30th. On the evening of the 9th the whole sky was covered with cirro-cumulus clouds which were beautifully tinted. In the west the color was very bright but it gradually faded toward the zenith.

Fall River: an after-glow of an intensely red color was observed on the afternoon of the 28th, which was the most brilliant of the sunset displays that have been observed at this place. The morning dawn of the 29th was equally as brilliant as the sunset of the preceding day.

Somerset, Bristol county: Mr. Elisha Slade reports that during the months of November and December a series of brilliant sunsets, and no less brilliant sunrises, were observed, which for displays of color and duration are unprecedented. These remarkable displays began on November 3d—no two consecutive mornings or evenings presenting the same phenomena in all the respective phases. During November the appearances were observed daily from the 3d to 11th, 13th, 25th, and 27th. The display of the 27th was longer than any previously observed. On that evening it consisted of an intense and steady light; and at 5.20 p. m. it was so bright that it was not difficult to read common print by it.

The morning of December 3d showed a wonderful change in the series of displays. The twilight bands were intensified beyond any previous degree, and were as clearly defined as the solar spectrum. Red, orange, yellow, and green bands

appeared in regular order and of extreme width, the display terminating with the appearance of a green sun. The evening display of the 3d was in silver and gold colors. The morning of the 4th was a repetition of that of the 3d. The evening of the 12th gave a scarlet light of nearly two hours duration; and the evenings of the 28th and 29th were of rose color. Mr. Slade further remarks: "in observing this series of meteorological phenomena, I noticed that if there was a rosy tint in the sky from 20° to 30° above the sun a few minutes before sunset, the display after sunset was red, crimson, or scarlet; if the sky was of a grayish white before sunset, the exhibit after sunset was of a silvery color; if the sky had a green tint previous to sunset, it afterwards changed to yellow; if purple, it changed to orange or gold; if blue, the color and shading were afterwards more variable. The evening twilight curve was dimmed or obliterated."

Michigan.—Detroit: a beautiful illumination in the eastern sky preceded the rising sun on the 9th. On the evening of the 28th the whole western sky was of a dark green color, interspersed with occasional patches of light.

Hillsdale, Hillsdale county: from the latter part of November until December 12th there were beautiful, flaming skies in the west at sunset, and from December 3d to 10th the same was observed in the east before sunrise.

Hudson, Lenawee county: unusually bright colors in the western sky were observed at sunset on numerous dates during December.

Minnesota.—Saint Paul: before sunrise on the 9th the entire eastern sky presented a luminous appearance. A bright red segment was also observed along the western horizon immediately after sunset of the same date. Similar conditions were also observed on the evenings of the 10th, 11th, 12th, 16th, 24th, 26th, 27th.

Missouri.—Concerning this phenomenon, Professor Francis E. Nipher, director of the "Missouri Weather Service," in his report for December, 1883, furnishes the following:

The beautiful illumination of the sky after sunset and before sunrise has continued during the month, having been observed whenever the clouds did not prevent. This phenomenon was first observed in the tropics, immediately after the great earthquake at Java, August 26th and 27th, which seems to have been the most violent one occurring during historic times. In the equatorial regions the illuminated sky, at high altitudes, was accompanied with the phenomenon of a green coloration of the sun. The latter phenomenon may be produced by a large excess of humidity, as is well known. At Ootacamund, in the Neilgherries, a gentleman "distinctly saw a green cloud-like mist pass across the sun, and then one of a reddish color, and the sun took the color of each of these clouds." The green sun was very marked in India, and caused great alarm. The red sky and green sun were seen in the West Indies and Panama on the 2d and 3d of September. On the 10th the red sky and green sun were seen in India. September 15th the phenomenon was seen in South Australia. September 21st it was seen at the Cape of Good Hope, November 9th in England, and by November 23d it was generally observed in Missouri and the northwestern states. Meteorological stations at high altitudes are now making observations for volcanic dust, which was thrown out from the mountain of Krakatowa in enormous quantities, with a view of determining whether the red sky is due to the presence of this dust. As the phenomenon seems to have extended from the East Indies westwardly around the equatorial belt and then spread gradually to the south and north, it is possible that volcanic dust has caused the phenomenon.

Nebraska.—Johnson, Nemaha county, 31st: for the past three weeks the western sky has presented a very brilliant appearance.

Red Willow, Red Willow county: a bright glow after sunset was observed on the 20th and before sunrise of the 21st; also on the 27th and 28th.

Genoa, Platte county: the last week of November and first ten days of December were remarkable for the brilliant, red glow in the sky after sunset and before sunrise. On several occasions the light assumed the peculiarities of the aurora.

Stella, Richardson county: the most remarkable phenomenon of the month was the red sky after sunset, lasting on several occasions from thirty-five to forty minutes longer than the ordinary twilight.

Nevada.—Carson City, Ormsby county: a beautiful sunset was observed on the 25th.

New Hampshire.—Grafton, Grafton county: remarkable sunsets were noted on the 10th, 20th, 28th and 29th.

Mount Washington: a beautiful, red sunset was observed on the 2d.

New Jersey.—Barnegat City: an hour after sunset on the 21st the western sky assumed a blood red color, which remained in view for a long interval afterwards. Similar appearances were also observed on other dates during the month.

Moorestown, Burlington county, 31st: the sunsets during December were marked by unusually bright colors, those of the 26th and 28th being especially brilliant. Preceding the sunrise of the 29th, the eastern sky presented a similar appearance to that observed during the evenings of the above dates.

South Orange, Essex county, 31st: the remarkable sunsets continued throughout December.

New York.—Poughkeepsie: the display of the crimson sky on the 28th was the grandest yet noticed at this place. Just after sunset the bright crimson illumination extended from the horizon to a quarter of the way up to the zenith and south along the crests of the mountains to the highlands. The upper margin was of a light pink hue edged with green, and blending further upward with the deep blue of the sky.

Rochester: an unusually brilliant sunrise occurred on the 13th. The red light appeared at 5.40 a. m., and at 6 a. m. it extended to the zenith and attained great brilliancy.

Buffalo: the sunset of the 5th was of unusual brightness.

Albany, 31st: the unusual sunset glow observed during November was also observed during December on the following dates: 2d, 3d, 12th, 21st, 28th; the sunrises of the 1st, 3d, 4th, 7th, 16th, 20th, 22d, were of similar appearance.

Ithaca, Tompkins county: a very bright sky was observed in the southwest from 6 to 6.15 p. m. of the 25th.

Friendship, Alleghany county: the eastern sky before sunrise on the 29th was unusually brilliant.

Humphrey, Cattaraugus county, 29th: a very red sunset occurred.

Ardenia, Putnam county: the sunsets during the latter half of the month were remarkable for brilliancy, diversity of colors, and long duration.

North Carolina.—Brevard, Transylvania county: a brilliant twilight, blended with orange, yellow, and pink colors, was observed on the evening of the 25th.

Ohio.—Ruggles, Ashland county: very red skies before sunrise and after sunset were frequently observed during the month. Those observed on the evening of the 10th and the morning of the 13th were especially bright.

Cleveland: unusually red skies during the evening were seen in the west on the 2d, 9th, 10th, 11th, 28th; the same peculiarity was seen in the east on the 2d, 10th, 12th, 13th 29th, and 30th.

The following extract is taken from the December report of the "Ohio Meteorological Bureau," Professor T. C. Mendenhall, director:

The unusual displays of color following the setting and preceding the rising of the sun, which were referred to in the last report, have continued to attract the attention of the observers during December.

Oregon.—Astoria, Clatsop county: brilliant sunsets were noted on the 12th, 13th, 14th to 17th.

Portland: bright-red sunsets were noted on the 1st, 2d, 3d, 5th, 6th, 7th, 9th, 10th, 11th, 13th, 15th, 16th, 18th.

Albany, Linn county, 31st: for the past five weeks the peculiar, lurid sunsets have been of frequent occurrence.

Pennsylvania.—Leetsdale, Allegheny county: the remarkable appearance of the western sky at sunset, as reported from this place during November, was also observed December 9th and 28th, that on the latter date having been especially bright.

Wilkesbarre, Luzerne county: a brilliant appearance of the western sky was observed on the 9th, the light reaching almost to the zenith. On the evening of the 11th the whole sky was tinted with red. The phenomenon appeared with varying brilliancy on the 12th, 13th, 28th; on the last date the display was extremely brigift.

Fallsington, Bucks county: very bright, red and yellow sunrises and sunsets were frequently observed during the month.

Tennessee.—Hon. A. J. McWhirter, Commissioner of Agriculture and Director of the "Tennessee Weather Service," in report for 1883, reports as follows:

"The red and yellow sunsets, which were such a feature during November, continued to be observed during December, and were most marked in brilliancy and depth of tint about the time of, or just preceding, the cold wave of the 15th *et seq.* Special mention of these phenomena was made as follows: At Parksville, on the 1st, 2d, 15th, 25th, and 26th; at Manchester, very brilliant on the 15th and 25th; Franklin, during the fair days; Chuckaluck, on the 15th and at sunrise on the 2d; Grief, at sunrise and sunset on all fair days; Trenton, on the 14th and 15th, at sunrise deeply tinged with yellow, on the 23d and 27th at sunset, and on the 16th and 29th at sunrise; at Hardison's Mills, on the 8th, 11th, and 12th, at sunset very deeply tinged, and 17th, 18th, 26th, 27th, 28th and 29th at sunrise and sunset.

Utah.—Salt Lake City, 31st: during the early part of the month the sunsets presented a remarkable appearance. An intensely red glow overspread the western sky, at times reaching to the zenith. It had the appearance of the light from an immense fire, and attracted great attention.

Vermont.—Strafford, Orange county: the sunsets on the 28th and 29th were of a bright red color, extending from northwest to southwest and to an altitude of 45°.

Charlotte, Chittenden county: the sky in the west and southwest exhibited an unusual redness on the evenings of the 28th and 29th.

Dorset, Bennington county, 31st: numerous, bright sunrises and sunsets were observed during the month.

Virginia.—Lynchburg: a reddish glow appeared in the western sky after sunset on the 2d, 5th, 17th, 21st, 26th, 28th.

Washington Territory.—Bainbridge island, Kitsap county: the mornings and evenings of nearly the whole month were characterized by brilliant, red sunrises and sunsets, the entire concave of the heavens being overspread with the illumination. Even in rainy and cloudy weather, when the sky was obscured, the beautiful, red lights penetrated through the clouds.

Spokane Falls, Spokane county, 26th: very peculiar lights have been observed in the eastern and western skies during the past few days, preceding sunrise and following sunset. The display on that date was especially bright, the western sky being illumined with a variety of colors.

Wisconsin.—Sussex, Waukesha county: for one and one-half hours before sunrise on the 9th the eastern sky was covered with a bright red light which extended to an altitude of 45°, and resembled the light from an extensive fire. The same phenomenon was observed on the morning of the 10th and after sunset of the same date.

Neillsville, Clark county, 31st: the brilliant sunrises and sunsets have attracted much attention. They were frequently observed during the month, the light reaching nearly to the zenith. The morning displays were apparently of greater brilliancy than those observed after sunset.

La Crosse: the sunset of the 14th was very brilliant, and of a deep red color; also on the 27th and 28th.

Rev Ph. Borrello, S. J., co-operating observer at Gozo, an island near Malta, Mediterranean sea, reports that a great light of red, mixed with other colors of the rainbow, was noticed before sunrise and after sunset over almost all Italy on November 28th, 29th and 30th, and almost throughout the month of December. The rays of the sun during the day were pale and light, and in the morning and toward evening they were of orange and red colors.

SUNSETS.

The characteristics of the sky, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from one hundred and fifty-six stations show 4,754 observations to have been made, of which five were reported doubtful; of the remainder, 4,749, there were 4,036, or 85.0 per cent., followed by the expected weather.

SUN SPOTS.

The following record of sun spots for the month of December, 1883, made at the Lawrence observatory, Amherst, Massachusetts, has been forwarded by Prof. David P. Todd:

Date—Dec., 1883.	No. of new		Disappeared by solar rotation.		Reappeared by solar rotation.		Total No. visible.		Remarks.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
1, 11 a. m....	1	2	0	0	1	2	3	15‡	
2, 3 p. m..	1	1	0	5	0	0	4	10‡	
3, 12 m	0	0	0	4	0	0	3	5	
4, 11 a. m....	0	1	1	2	0	0	2	3	
6, 1 p. m....	2	6	1	2	2	6	2	6	
7, 4 p. m....	0	0	0	0	0	0	2	6	
10, 12 m	4	45‡	0	0	.....	.....	6	50‡	Many of the spots small.
12, 11 a. m....	1	20‡	0	0	.....	.....	7	70‡	Do.
13, 11 a. m..	0.	0	0	0	0	0	7	70‡	Do.
15, 2 p. m....	0	0	1	5‡	0	0	6	50‡	Do.
16, 10 a. m....	0	0	0	0	0	0	6	50‡	
17, 4 p. m....	0	0	0	10‡	0	0	6	35‡	
20, 10 a. m....	2	20‡	.....	.....	.....	.....	6	35‡	
22, 11 a. m....	1	15‡	1	5	.....	.....	5	60‡	
26, 8 a. m....	.....	.....	.....	.....	.....	.....	3	45‡	One of spots very large.
28, 9 a. m....	1	2	0	0	1	2	4	45‡	Do.
29, 10 a. m....	0	0	0	0	0	0	4	45‡	Do.

Faculæ were seen at the time of every observation. ‡Approximated.

Mr. William Powrie, at Sussex, Waukesha county, Wisconsin, reports having observed on the 25th a large spot on the sun, with the naked eye, and on viewing the sun through a nine-inch telescope, a group of six spots was observed in the southwest quadrant of the sun.

Mr. H. D. Gowey, of North Lewisburg, Champaign county, Ohio, reports that sun spots were observed on all clear days during the month; they were most numerous on the 21st; least numerous and smallest on the 5th; and largest on the 28th.

Wellington, Sumner county, Kansas.—On the 27th and 28th, a dark spot was observed on the sun, with the naked eye.

METEORS.

Woodstock, Harford county, Maryland.—A large and brilliant meteor, moving in a southwesterly direction, was observed at 8.59 p. m. of the 1st.

Lansing, Michigan.—At 11 p. m. of the 1st a large meteor was observed in the southern sky.

Indianola, Texas.—A brilliant meteor was seen in the southeastern sky at 6.20 p. m. of the 1st.

Alexandria, Harrison county, Dakota.—At 7.20 p. m. of the 9th a bright meteor appeared in the western sky and moved toward the south, its course not being in a direct line but having a succession of curves. It left a track which remained visible for several seconds after its disappearance.

Sussex, Waukesha county, Wisconsin.—Between 5.45 and 6 a. m. of the 11th a shower of meteors was observed falling in all directions. One as large as "Jupiter" was observed in the northern sky, and moving rapidly in an easterly direction; it disappeared when at about 20° from where it first appeared.

Variety Mills, Nelson county, Virginia.—At 6 p. m. of the 18th a meteor was observed to pass from near the zenith in a south-southwesterly direction. It increased rapidly in brilliancy and changed color during its flight.

Topeka, Kansas.—On the night of the 23d, while the moon was shining brightly, there suddenly appeared a bright light, resembling a flash of lightning, which vividly illuminated the surroundings. In the western sky was observed a long broad streak of light which remained for fully three minutes, and finally concentrated into a ball of light, apparently the size of the moon, which remained visible for more than ten minutes.

Oswego, New York.—A brilliant meteor is reported to have passed over the city of Auburn on the night of the 21st, which lighted up the streets brightly.

Wellsborough, Tioga county, Pennsylvania.—A large meteor passed over this place in a direction from northeast to southwest at 10 p. m. of the 28th.

Jacksonville, Florida.—A meteor of unusual brilliancy was observed at 12.05 a. m. of the 29th. It started from a point about 10° southwest of the zenith and moved slowly toward

the west-southwestern horizon, exploding when at an altitude of 20°.

Charleston, South Carolina.—At about 8.30 p. m. of the 30th a meteor passed over this city in a southeasterly direction, leaving behind it a long trail.

Meteors were also observed at the following places:

1st.—Springfield, Arkansas; Webster, Dakota; Griffin Station, Indiana; Davenport, Iowa; Clay Centre, Kansas.
2d.—Springfield, Arkansas.
3d.—Burlington, Iowa.
4th.—Davenport, Iowa; Rowe, Massachusetts.
8th.—Salina, Kansas.
11th.—Stateburg, South Carolina.
12th.—Yuma, Arizona; Alexandria, Dakota; Webster, Dakota; Fort Canby, Washington Territory.
17th.—Andersonville, Georgia; Liberty Hill, Louisiana.
18th.—Webster, Dakota; Davenport, Iowa.
20th.—Fall River, Massachusetts.
21st.—Somerset, Massachusetts.
24th.—Red Willow, Nebraska; Allison, Kansas.
25th.—Davenport, Iowa; North Volney, New York.
31st.—Beloit, Wisconsin.

EARTHQUAKES.

Lead Hill, Boone county, Arkansas.—A shock of earthquake occurred at Melbourne, Izard county, at 9.20 a. m. of the 5th. Apparently the shock came from the west or west-southwest. It was very distinct, causing buildings to shake, and was accompanied by a sound resembling distant thunder.

The following note is taken from the "New York Times" of December 7, 1883:

SAINT LOUIS, MISSOURI, *December* 6, 1883.—Seven shocks of earthquake occurred yesterday at Rovender Springs. They lasted forty seconds, and broke glass-ware and crockery in stores and dwellings. Large rocks were loosened and fell in the cuts of the Kansas City, Springfield, and Memphis railroad near Rovender Springs. The shock was accompanied by a loud noise, and there was a violent jar of the earth.

A similar report of the earthquake above referred to, with some verbal changes, the most notable being *severe* instead of *seven* in the first word, was published in the "New York Tribune" of the same date.

Los Angeles, California.—A slight shock of earthquake occurred here at 11.40 p. m. of the 12th. The vibration, which was distinctly felt, was of such short duration that its direction was not determined. On the 13th another slight shock of short duration occurred.

Poway, San Diego county, California.—A slight shock of earthquake occurred here at 3 p. m. of the 16th.

Lisbon, Portugal, December 23, 1883.—At 1.30 a. m. of the 22d a slight earthquake shock, which was not generally noticed, occurred here. At 3.30 a. m. a stronger shock, lasting twelve seconds and accompanied by heavy rumblings, awoke the entire population of the city. Some old buildings and a number of chimneys were damaged. At Setuval, eighteen miles southeast of Lisbon, it was so severe as to cause much alarm.

DROUGHT.

Andersonville, Sumter county, Georgia, 3d.—Serious drought prevails in this vicinity; springs are becoming dry that have not failed for many years.

Mayport, Duval county, Florida, 30th.—Vegetation in this vicinity is suffering in consequence of drought.

Montgomery, Alabama, 27th.—Some localities south of this city are still suffering from the late unprecedented drought. Catoma creek is so low that it may be forded at any point.

Jacksonville, Florida, 30th.—The strawberry vines in this vicinity have been seriously damaged by the prevailing drought. The crop is reported to be a failure.

Westborough, Worcester county, Massachusetts.—The past month has been very dry in this vicinity. Nearly all of the precipitation was in the form of snow. Many wells are dry and there is a scarcity of water for cattle.

Red Bluff, California, 31st.—The present season has been so dry that cattle and sheep have suffered in consequence of scarcity of water. Owing to the very dry condition of the soil many farmers were compelled to stop plowing and seeding. The rain of this season is less than half the amount of the corresponding months of 1882.

POLAR BANDS.

Lead Hill, Arkansas, 3d, 15th, 16th, 27th.
Los Angeles, California, 12th.
Archer, Florida, 6th, 15th, 16th, 19th, 24th.
Limona, Florida, 15th to 18th.
Pensacola, Florida, 13th, 15th.
Larchland, Illinois, 1st.
Riley, Illinois, 3d.
Salina, Kansas, 10th.
Gardiner, Maine, 4th.
Clear Creek, Nebraska, 12th, 13th, 16th.
North Platte, Nebraska, 20th.
Vineland, New Jersey, 1st, 13th.
Mountainville, New York, 4th.
Wauseon, Ohio, 3d, 10th, 11th, 20th, 26th, 29th.
Block Island, Rhode Island, 7th.
Nashville, Tennessee, 2d, 6th, 7th, 8th, 11th, 14th.
Wytheville, Virginia, 9th, 12th, 29th.

ZODIACAL LIGHT.

Little Rock, Arkansas, 8th, 12th.
Webster, Dakota, 23d, 24th, 26th to 29th.
Archer, Florida, 19th, 20th, 26th, 27th, 28th.
Pensacola, Florida, 1st, 12th, 13th.
Allison, Kansas, 30th.
Cambridge, Massachusetts, observed, 21st, 28th, 29th; suspected, 22d.
Escanaba, Michigan, 3d, 4th, 11th, 12th, 16th, 19th, 24th.
Brevard, North Carolina, 25th, 26th, 28th.
Nashville, Tennessee, 1st, 25th, 26th, 27th.
Wytheville, Virginia, 26th.

MIGRATION OF BIRDS.

Geese flying southward.—Cairo, Illinois, 18th; Chicago, Illinois, 4th, 16th; Cantonment, Indian Territory, 25th, 31st; Fort Madison, Iowa, 17th, 19th, 21st, 25th; Red Willow, Nebraska, 20th; Mountainville, New York, 1st; Narragansett Pier, Rhode Island, 2d; Point Judith, Rhode Island, 8th, 14th, 15th. *Flying northward.*—Cairo, Illinois, 20th; Fort Madison, Iowa, 15th, 18th.

Ducks flying southward.—Fort Smith, Arkansas, 23d; Augusta, Georgia, 16th. *Flying northward.*—Edgington, Illinois, 8th. *Flying westward.*—Fort Stockton, Texas, 17th.

PRAIRIE AND FOREST FIRES.

Fort Smith, Arkansas, 4th, 28th.
Fort Meade, Dakota, 12th.
Cantonment, Indian Territory, 26th.
Fort Reno, Indian Territory, 1st, 2d, 3d.
Elk Falls, Kansas, 28th.

SAND STORMS.

Fort McDowell, Arizona, 11th.
San Carlos, Arizona, 10th, 12th, 15th.
Yuma, Arizona, 12th, 20th.
Fort Reno, Indian Territory, 25th.
Fort Concho, Texas, 26th.

ERRATUM.

On page 1 of the November REVIEW, under barometric "departures from the normal values for the month", for from .01 to 0.3 above the normal in the south Atlantic and east Gulf states, read from .01 to .03.

NOTES AND EXTRACTS.

The following extract relating to the Java volcanic eruption and earthquake of August, 1883, is taken from the "New York Herald" of December 7, 1883:

BOSTON, *December* 7.—The bark "Bessie Baker," from Manilla, May 25, via Batavia, which has arrived here, brings an interesting story of the Java earthquake. She reports that on August 27, Babie island bearing north by west, distant five miles, at daylight she noticed a heavy bank rising from the westward, which continued to rise, the barometer suddenly falling to 29.40 and again suddenly rising at one jump to 30.70. Had everything furled and had no sooner let go the port anchor than heavy showers of sand and ashes began falling about noon. Then it became darker than the darkest night, the wind blowing a perfect hurricane and the sea perfectly smooth. A heavy rumbling like thunder was heard continually; the sky was lightened by flashes of lightning; and a strong smell of sulphur pervaded the air, making it difficult to breathe. Altogether, it formed one of the wildest and most awful experiences imaginable. The tide was setting strongly to the westward throughout the gale at a rate of fourteen knots. The sky became clearer at 3 p. m., though the ashes contined to fall. On the 29th, while passing the straits of Sunda, we saw a large number of dead bodies, and the water for miles was covered with trees and ashes, the sea for six hundred miles being a field of lava.

The following table is taken from the December weather report prepared by Professor F. H. Snow, of Lawrence, Kansas. The means as given are determined from daily observations made at 7 a. m., 2, and 9 p. m.:

December.	Mean temperature.	Maximum temperature.	Minimum temperature.	Winter days.*	Zero days.	Rain (inches).	Snow (inches).	Rainy days.	Thunder-storms.	Mean cloudiness.	Humidity.	Number of fogs.	Miles of wind.	Mean barometer.	Maximum barometer.	Minimum barometer.
	°	°	°													
1868	24.29	53.0	—16.5	25	4	2.13	16.00	6	0	49.16	77.2	1	.....	29.205	29.847	28.497
1869	29.92	65.0	4.0	7	0	0.87	5.50	6	0	56.56	77.2	4	.....	29.187	29.550	28.640
1870	28.70	64.0	—10.0	15	4	0.72	6.50	5	0	49.79	73.1	1	.....	29.192	29.705	28.566
1871	24.91	58.0	— 6.0	21	4	1.12	5.75	6	0	45.27	65.9	1	.....	29.192	29.743	28.516
1872	19.93	58.5	—18.0	24	8	1.24	11.00	4	0	44.30	65.7	1	11,533	29.299	29.674	28.681
1873	31.37	67.5	9.0	15	0	4.39	3.50	11	2	61.50	76.3	0	12,254	29.199	29.655	28.666
1874	31.01	55.5	— 3.0	19	1	1.17	7.50	5	0	47.00	79.4	1	11,820	29.235	29.687	28.704
1875	39.35	73.0	0.0	9	1	3.55	0.00	5	2	49.14	66.6	0	13,686	29.047	29.528	28.530
1876	33.60	66.0	— 5.0	24	3	0.43	4.00	5	0	37.85	68.9	0	11,063	29.260	29.708	28.748
1877	44.43	68.0	10.0	2	0	2.21	0.50	10	2	58.17	74.4	0	10,683	29.191	29.575	28.596
1878	23.05	53.0	— 6.0	25	7	1.98	20.00	6	0	53.75	65.7	1	9,096	29.268	29.735	28.714
1879	26.23	65.5	— 9.0	21	2	2.39	3.00	5	1	51.83	74.0	2	12,821	29.172	29.702	28.534
1880	25.84	61.0	—12.0	20	2	0.43	1.50	8	0	54.08	96.7	4	11,661	29.243	29.733	28.367
1881	40.10	63.0	18.0	1	0	0.90	1.00	4	0	55.26	68.3	1	12,679	29.214	29.544	28.735
1882	31.25	58.0	— 6.5	16	1	1.24	5.00	5	0	61.61	76.7	5	11,247	29.189	29.985	28.478
1883	33.72	63.0	— 3.5	13	0	0.77	2.00	8	0	45.24	68.8	2	13,680	29.199	29.612	28.584
Mean	29.86	61.9	— 3.0	16	2	1.60	5.80	6	0.5	51.34	71.8	2	11,852	29.205	29.686	28.597

* In this column are given the number of days whose mean temperature was below 32°.

Chart I. Tracks of Low-Barometer Areas, December, 1883.

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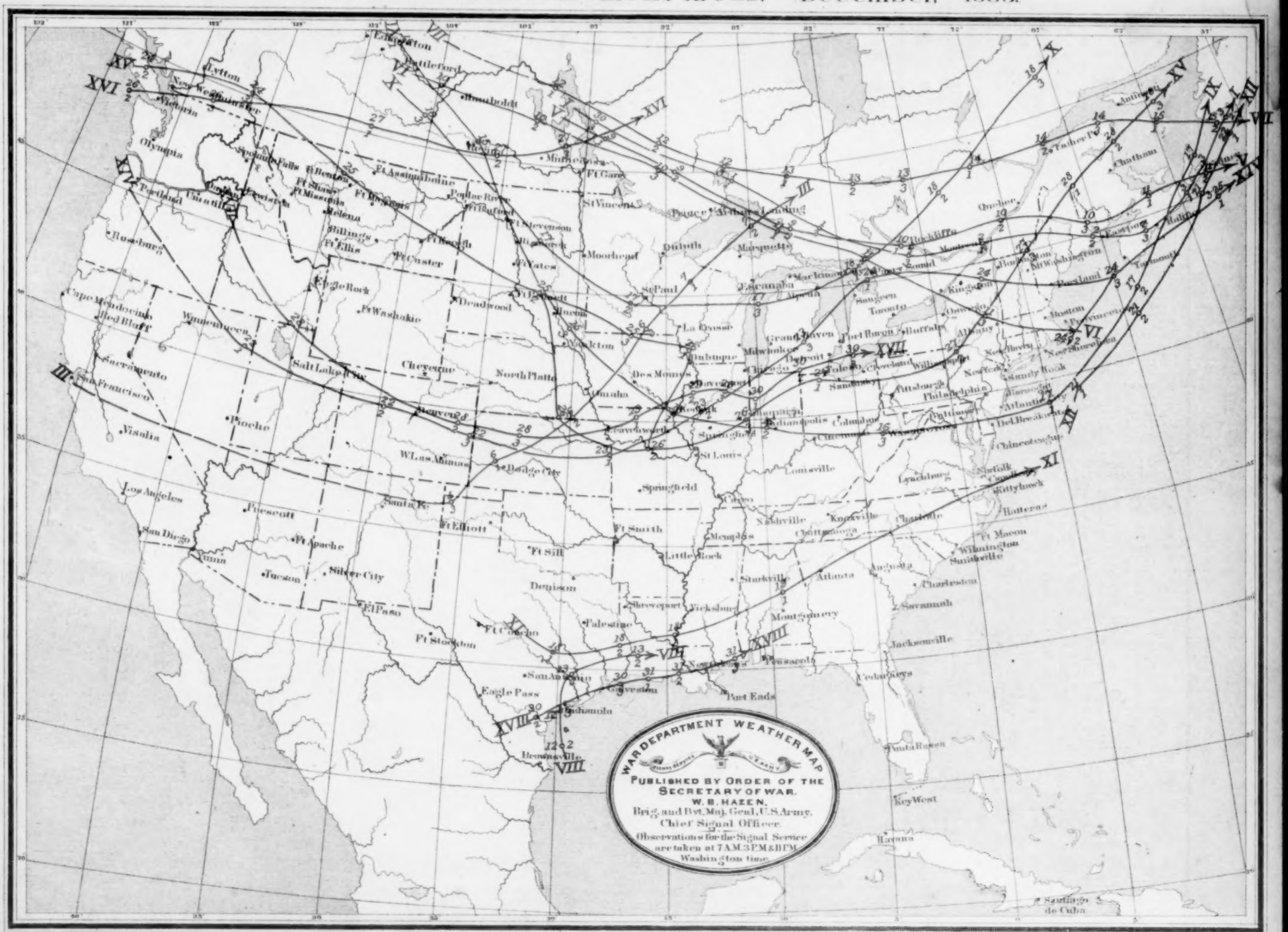
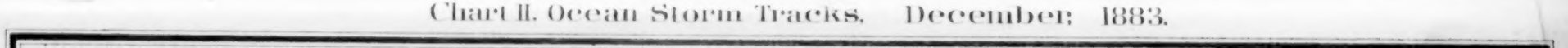


Chart II. Ocean Storm Tracks. December; 1883.



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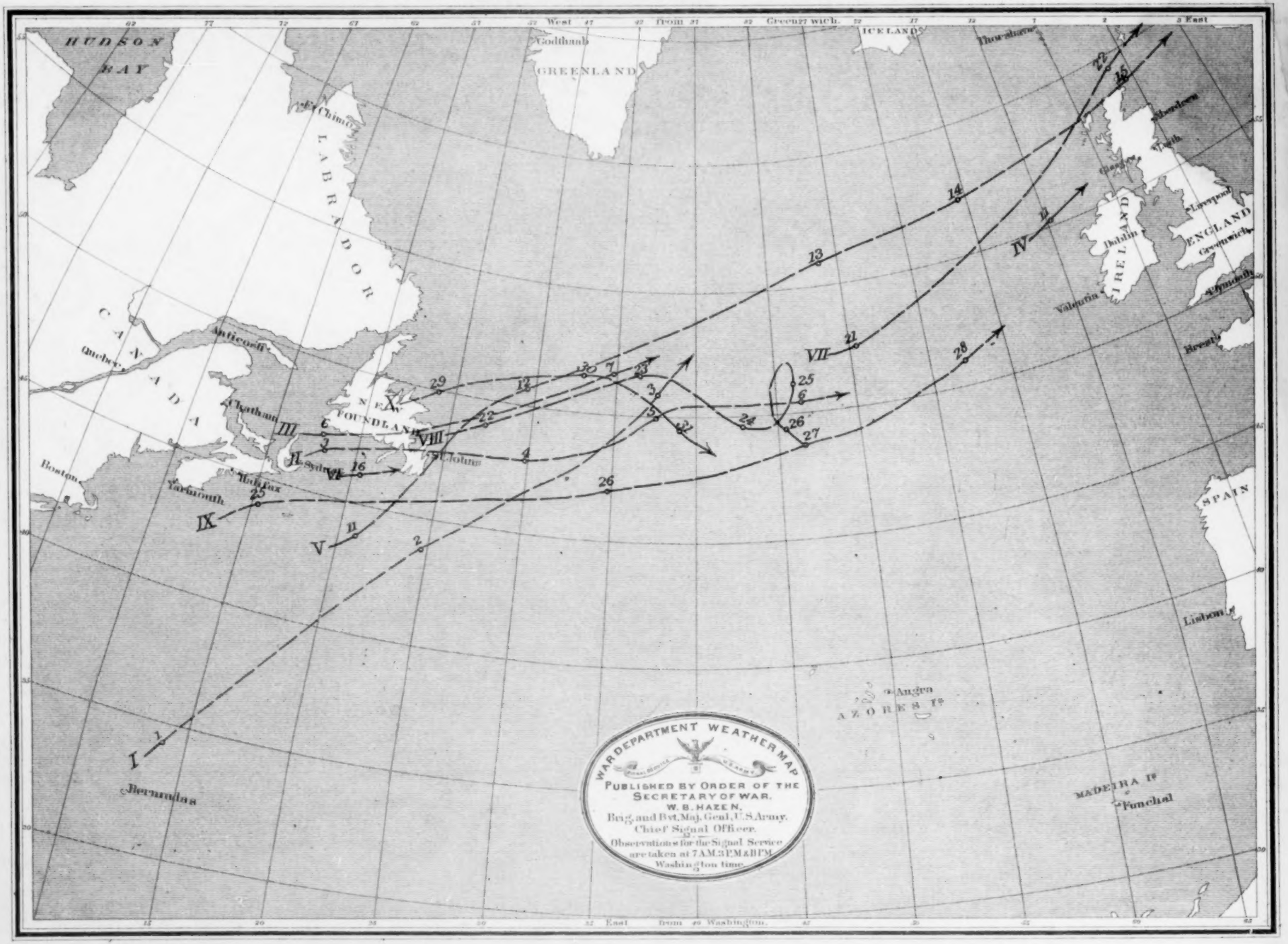


Chart III. Isobars, Isotherms, and Winds. December; 1883.

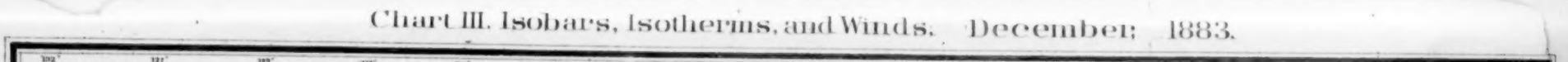


Chart III. Isobars, Isotherms, and Winds. December; 1883.

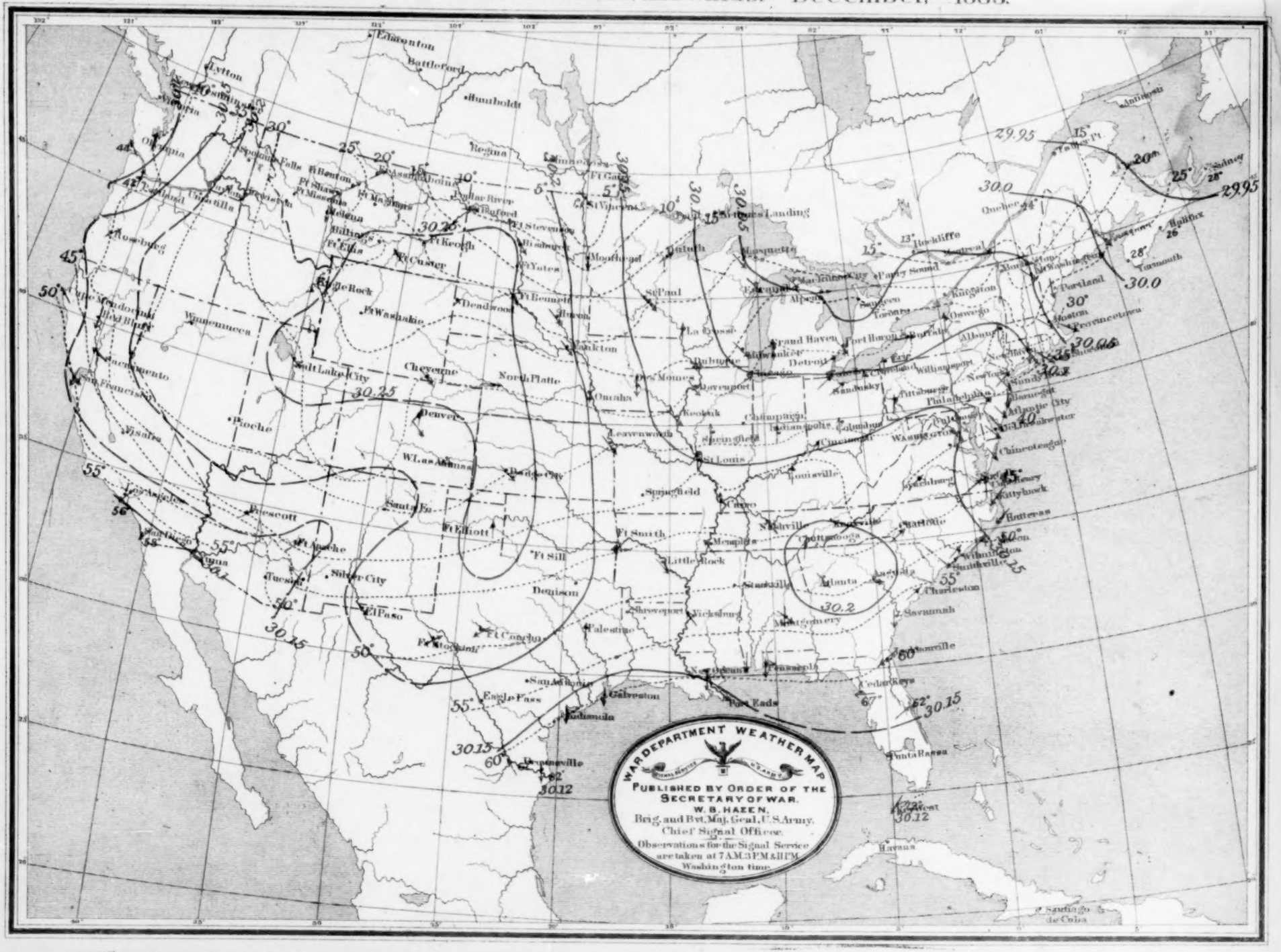

WAR DEPARTMENT WEATHER MAP
PUBLISHED BY ORDER OF THE SECRETARY OF WAR.
W. B. HAZEN,
Brig. and Bvt. Maj. Genl. U.S. Army,
Chief Signal Officer.
Observations for the Signal Service are taken at 7 A.M. 3 P.M. & 11 P.M. Washington time.

Chart IV. Precipitation, December: 1883.

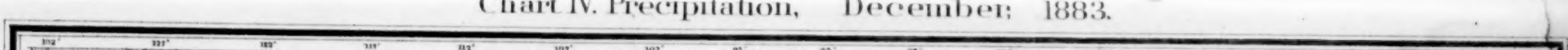
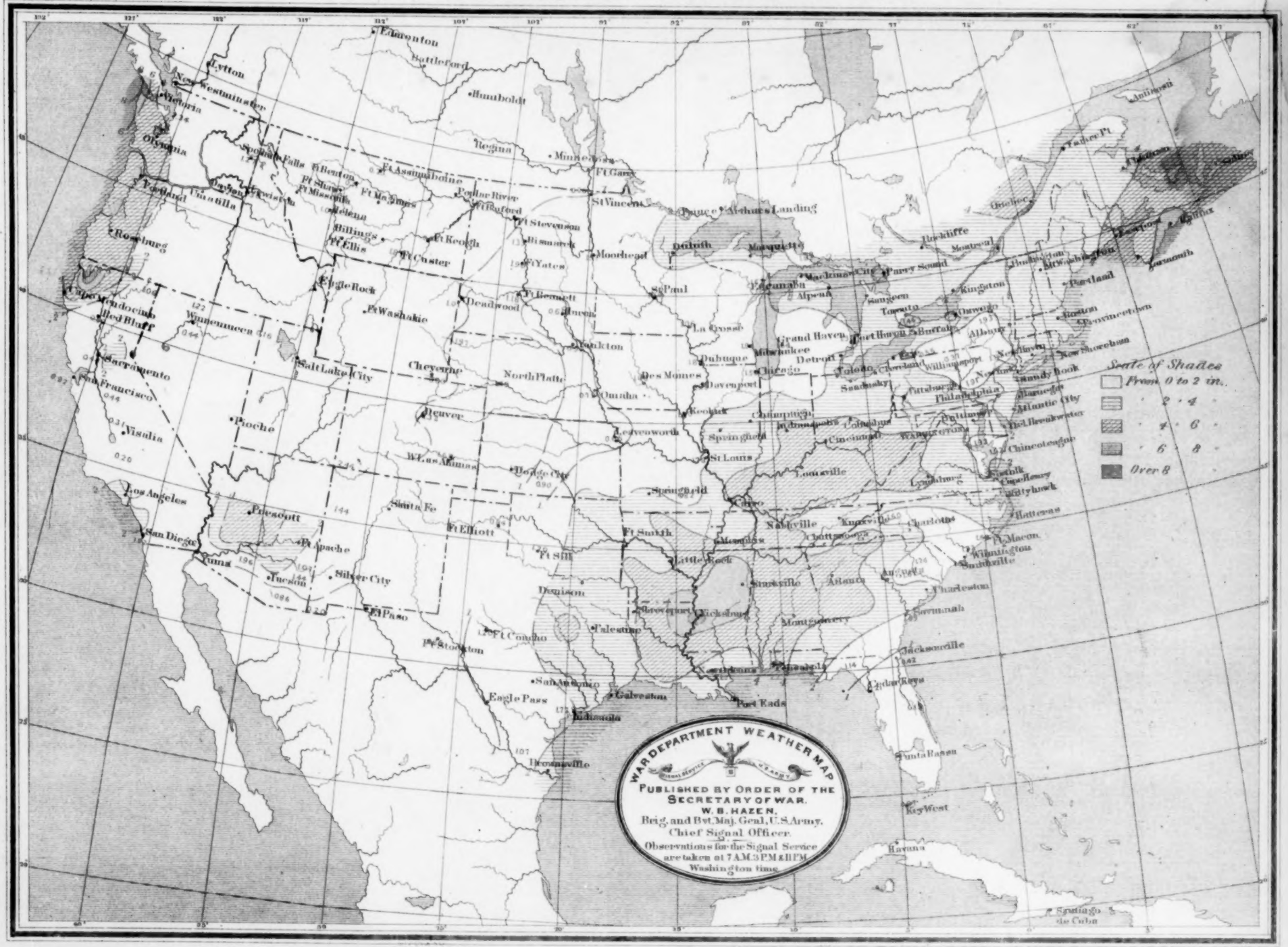


Chart IV. Precipitation, December; 1883.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Scale of Shades
From 0 to 2 in.
2 · 4 ·
4 · 6 ·
6 · 8 ·
Over 8

Voluntary observers of the Signal Service, on land, from whom meteorological reports were received in time to be used in the preparation of the Monthly Weather Review for December, 1883.

Observer.	Place of observation.
Arden, Thos. B.	Garrison, N. Y.
Anderson, Dr. W. W.	Stateburg, S. C.
Abbott, Dr. E. K.	Salinas City, Cal.
Andrews, Luman	Southington, Conn.
Altaffer, J. M.	Independence, Kans.
Adriance, Chas. E.	Hector, N. Y.
Allen, J. H.	Elk Knob, N. C.
Braly, Rev. S. H.	Clarksville, Tex.
Boies, A. H.	Hudson, Mich.
Blachly, C. P.	Manhattan, Kans.
Bryant, J. M.	Andersonville, Ga.
Beloit College	Beloit, Wis.
Bear, John P.	Boston, Mass.
Bell, Joseph	Franklin, Pa.
Bowen, F. W.	Humboldt, Iowa.
Brainerd, Dr. H. G	Independence, Iowa.
Baker, Dr. Henry B.	Lansing, Mich.
Beall, Dr. R. L	Lenoir, N. C.
Brendel, Fred	Peoria, Ill.
Bentley, David	Princeton, Cal.
Bowman, Peter	Ruggles, Ohio.
Boerner, Prof. Chas. G.	Vevay, Ind.
Bartlett, E. B.	Vermillion, N. Y.
Baldwin, A. L.	Bethel, Conn.
Bardsley, Jas. G	Nephi, Utah.
Briggs, John	Albany, Oreg.
Boggs, W. R.	Brevard, N. C.
Beans, Thos. J.	Moorestown, N. J.
Boyd, Joseph	Oskaloosa, Iowa.
Betts, Arthur	Webster, Dak.
Beecher, Chas	Newport, Fla.
Bryant, A. F.	Clear Creek, Nebr.
Barney, Ahira	Bristol, N. H.
Breed, J. E.	Embarrass, Wis.
Buck, Mrs. R.	Red Willow, Nebr.
Belville, P.	Saint George's Del.
Casey, Geo.	Auburn, N. Y.
Conrad, Prof. C. P	Fayetteville, Ark.
Carter, Rev. Dr. W. H.	Tallahassee, Fla.
Cuiver, G. E	Vermillion, Dak.
Calhoun, P. B.	Austin, Tenn.
Carman, Chas. W.	Ann Arbor, Mich.
Carpenter, Dr. Wm. B.	Leavenworth, Kans.
Crawford, E. A.	Liberty Hill, La.
Curtiss, G. G.	Fallston, Md.
Cornell University	Ithaca, N. Y.
Chapin, Adams	Poway, Cal.
Cutler, B. B.	Heath, Mass.
Cocke, A. R	Indianola, Iowa.
Cutting, Hiram A.	Lunenburgh, Vt.
Crosier, Adam	Laconia, Ind.
Cheney, Wm.	Minneapolis, Minn.
Caulkins, John S.	Thornville, Mich.
Clark, T. A.	Weldon, N. C.
Crump, M. H	Bowling Green, Ky.
Chandler, Chas. H	Ripon, Wis.
Colt, H. H.	Nora Springs, Iowa.
Crawford, D. F. G.	Leetsdale, Pa.
Coffin, Prof. S. J.	Easton, Pa.
Carlton College	Northfield, Minn.
Chandler, Dr. W. J.	South Orange, N. J.
Collin, Prof. Alonzo	Mount Vernon, Iowa.
Cochran, Wm. P.	Clay Centre, Kans.
Cass, John C	Allison, Kans.
Couch, E. D.	Contoocookville, N. H.
Chase, Pliny E.	Haverford College, Pa.
Dunton, W. R.	Dorset, Vt.
Davis, Jacob	Rowe, Mass.
Day, Theodore	Dyberry, Pa.
Dickinson, Jas. R.	Guttenberg, Iowa.
Doton, Hosea	Woodstock, Vt.
Deming, Hiram D.	Wellsborough, Pa.
Dixon, Geo.	Hampton, Va.
Dozier, Wm.	Mattoon, Ill.
Dawson, H. T	Dudley, Mass.
Dewhurst, Rev. E	Voluntown, Conn.
Downs, Edw. C.	Alexandria, Dak.
Drake W. T.	Marshall, Mich.
Eckstein, M	Conception, Mo.
Ellis, John	Marquette, Nebr.
Elliott, J. C.	Swanwick, Ill.
Fernald, Prof. M. C.	Orono, Me.
Farquhar, Allan	Sandy Springs, Md.
Friend, Chas. W.	Carson City, Nev.
Fleming, John	Readington, N. J.
Ferris, B. F.	Sunman, Ind.
Foss, E. T	Hydesville, Cal.
Geddings, Dr. W. H.	Aiken, S. C.
Gates, W. B.	Burlington, Vt.
Gordon, Dr. Geo. G.	Swartz Creek, Mich
Gillingham, W.	Accotink, Va.
Gruthwohl, John	Blooming Grove, Pa.
Gillingham, Milnor	Falsington, Pa.
Gardiner, R. H.	Gardiner, Me.
Gowey, H. D.	North Lewisburg, Ohio.
Gibson, John H.	Salina, Kans.
Green, Dr. Jesse C.	West Chester, Pa.
Gerrish, S. H.	Sacramento, Cal.
Hurlin, Rev. Wm	Antrim, N. H.
Harvard Col. Observ'y.	Cambridge, Mass.
Hammitt, John W	College Hill, Ohio.
Heaton, Isaac E.	Fremont, Nebr.
Helm, Thos. B.	Logansport, Ind.
Hilton, John B	Paterson, N. J.
Hoskinson, R. M	Bainbridge Island, Wash.
Hunter, Dr. T. C.	Wabash, Ind.
Haywood, John	Westerville, Ohio.
Hyde, G. A.	Cleveland, Ohio.
Hassler, B. K.	Chambersburg, Pa.
Howe, Edmund D.	Table Rock, Nebr.
Harrison, R. A.	Caldwell, N. J.
Hodge, Rev. F. B.	Wilkesbarre, Pa.
Harper, G. W.	Cincinnati, Ohio
Hurley, John M.	Lancaster, Wis.
Hartzler, J. A.	Mottville, Mich.
Hall, J. B	Worcester, Mass.
Houghton Farm Experiment Station.	Mountainville, N. Y.
Heacock, J. L.	Quakertown, Pa.
Hazen, L. G	Terre Haute, Ind.
Hills, F. T	Vineland, N. J.
Hooker, P. J	Rapid City, Dak.
Hoyt, F. C.	Easton, Pa.
Hyslop, John	San Francisco, Cal.
Ingram, Dr. J.	Vineland, N. J.
James, John W	Marengo, Ill.
Johnson, Thos. N.	Canal Dover, Ohio.
Jackman, J. W.	Utica, Nebr.
Jones, Ira B.	Neillsville, Wis.
Jones, Dr. E U.	Taunton, Mass.
Jordan, Dr. M. D. L.	Milan, Tenn.
Kellogg, J. H.	Battle Creek, Mich.
Knapp, J. G	Limona, Fla.
Keese, G. Pomeroy	Cooperstown, N. Y.
Kuhne, F. W.	Fort Wayne, Ind.
Kimball, Perley R	Grafton, N. H.
Kent, Miss Emily	Phillipsburg, N. J.
Kirkwood, E.	Glenwood, Ind.
Keeler, W. F.	Mayport, Fla.
Kendall, J. S.	Honey Grove, Tex.
Lovewell, Miss B. E.	Topeka, Kans.
Lueps, Miss Emma	Manitowoc, Wis.
Lincoln, A. T.	Marion, Va.
Lay, Dr. Jas. C.	Pueblo, Colo.
Loomis, J. C.	Jeffersonville, Ind.
Martin, Horace	Stella, Nebr.
Mell, Prof. P. H.	Auburn, Ala.
McDonogh Institute	McDonogh, Md.
Marshall, Gregory	Cresco, Iowa.
McCready, Miss L. A.	Fort Madison, Iowa.
Moore, C. R.	Johnsontown, Va.
Munn, A.	Kalamazoo, Mich.
Metcalf, Dr. John G.	Mendon, Mass.
Micklem, J. Howard.	Variety Mills, Va.
Meehan, Thos.	Germantown, Pa.
Moore, Nathan	Grampian Hills, Pa.
McKenzie, Miss M. L.	Peru, Nebr.
Mikesell, Thos.	Wauseon, Ohio.
Madison University	Madison, Wis.
Mt. St. Mary's College.	Emmittsburgh, Md.
Neely, T. S.	Barnesville, Tex.
Neal, Dr. J.	Archer, Fla.
Newbegin, John D.	Anna, Ill.
Nelson, Dr. Wm. H.	Northport, Mich.
Neill, Thos	Sandusky, Ohio.
Newcomb, G. S.	Westborough, Mass.
Nourse, H. D.	Washington, D. C.
Noll, A. B.	Somerville, N. J.
Osmond, Prof. I. T.	State College, Pa.
Owsley, Dr. J. B.	Jacksonburg, Ohio.
Osborn, Dr. Thos C.	Cleburne, Tex.
Pearce, Thomas	Eola, Oreg.
Parmelee, Francis D.	Hillsdale, Mich.
Partrick, J. M.	North Volney, N. Y.
Purdue University	Lafayette, Ind.
Pierson, Rev. J.	Ionia, Mich.
Powrie, W.	Sussex, Wis.
Prosser, Chas. S	Ithaca, N. Y.
Parmelee, J. B.	Nebraska City, Nebr.
Parks, C. M.	Logan, Utah
Quarterman, Fred	Flushing, N. Y.
Remington, C. V. S.	Fall River, Mass.
Riggs, J. P.	Larchland, Ill.
Rockwood, Prof. C. G.	Princeton, N. J.
Rose, O. E.	Highlands, N. C.
Rogers, Jesse D	Friendship, N. Y.
Rodman, Thos. R.	New Bedford, Mass.
Runge, C.	New Ulm, Tex.
Robertson, T. D.	Rockford, Ill.
Russell, Geo. W	Wellsburg, W. Va.
Ross, W. J	Pretty Prairie, Kans.
Shriver, E. T.	Cumberland, Md.
Seltz, Chas	De Soto, Nebr.
Scott, Thos. G.	Forsyth, Ga.
Stucky, Dr. C. T.	Helvetia, W. Va.
Stern, Jacob T.	Logan, Iowa.
Snow, Prof. F.	Lawrence, Kans.
Spilman, J. J	Pierce City, Mo.
Slade, Elisha	Somerset, Mass.
Slenker, Mrs. E. D.	Snowville, Va.
Scribner, H. F. J.	Strafford, Vt.
Shriver, Howard	Wytheville, Va.
Sweeney, A. B	Polo, Ill.
Smith, H. D.	Monticello, Iowa.
Starky, Nathan	Stockham, Nebr.
Shahan, Chas. C.	Edgington, Ill.
Snell, S. C.	Amherst, Mass.
Safford, John H.	Williamstown, Mass.
Sadler, H. E.	Emporia, Kans.
State Agricultural Col.	Fort Collins, Colo.
Samostz, Oscar	Austin, Tex.
Sweet, Fred	Grand Rapids, Mich.
State Public School	Coldwater, Mich.
Swezey, G. D.	Crete, Nebr.
State School of Mines.	Golden, Colo.
Smith, Rev. D. W.	Troy, Pa.
Thommen, G	Millville Depot, Pa.
Trembley, Dr. J. B.	Oakland, Cal.
Tutwiler, H., LL.D.	Green Springs, Ala.
Todd, Prof. David P.	Amherst, Mass.
Teele, Rev. A. K.	Milton, Mass.
Truman, Geo. S	Genoa, Nebr.
Turnbo, Silas C.	Protem, Mo.
Tillinghast, C. B.	Albany, N. Y.
Venable, Prof. F. P.	Chapel Hill, N. C.
Van Inwegen, Chas. F.	Port Jervis, N. Y.
Voegeli, Adolphus	Des Moines, Iowa.
Wilson, W. E	Cedar Rapids, Iowa.
Woodworth, C. E.	Klantone, N. Y.
Wild, Rev. E. P.	Newport, Vt.
Williams, Rev. C. F.	Ashwood, Tenn.
Wing, Miss M. E	Charlotte, Vt.
West, Silas	Cornish, Me.
Watson, Evan	Fort Scott, Kans.
Went, E. C	Frankfort, Ky.
Whitcomb, Dr. G. G.	Ogreeta, N. C.
Westerfield, J. H.	Springfield, Ark.
Watters, Dr. Jas.	Holton, Kans.
Williamson, J. A.	Johnstown, N. Y.
Wylie, Wm	Mount For st, Canada.
Whittington, G.	Mount Ida, Ark.
Walton, J. P	Muscatine, Iowa.
Wait, S. E.	Traverse City, Mich.
Woodstock College	Woodstock, Md.
Wolfe, John H	Wellington, Kans.
West, Dr. Jos. O.	Princeton, Mass.
Washington Aqueduct	Receiving Reservoir, D. C. Distributing Reservoir, D. C. Great Falls Reservoir, Md. Rock Creek Bridge, D. C.
Winipiseogee Lake, Cotton and Woolen Manufacturing Co.	Weir's Bridge, N. H. Wood-tock, N. H. Wolfborough, N. H. Lake Village, N. H. Bristol, N. H. Belmont, N. H. Ashland, N. H.
Wadsworth, Dr. J. L. R.	Collinsville, Ill.
Willis, O. R., A. M., Ph. D	White Plains, N. Y.
Williams, Dr. A. C.	Elk Falls, Kans.
Wright, W. F.	Johnson, Nebr.
Widman, Rev. C. M.	Grand Coteau, La.
Whitney, Chas. E.	Humphrey, N. Y.
Yetter, Wm. G	Catawissa, Pa.
Yates, T. P.	Factoryville, N. Y.
Young, Geo. R	Penn Yan, N. Y.
Zimmerman, F. C.	Bunker Hill, Ill.

Military posts from which meteorological reports were received, through the Surgeon General of the Army, in time to be used in the preparation of the Monthly Weather Review for December, 1883.

Abraham Lincoln, Fort, Dak.	Columbus, Fort, N. Y.	Keogh, Fort. Mont.	Monroe, Fort, Va.	Plattsburgh Barracks, N. Y.	Sully, Fort, Dak.
Alcatraz Island, Cal.	Concho, Fort, Tex.	Lewis, Fort, Colo.	Meade, Fort, Dak.	Preble, Fort, Me.	Sisseton, Fort, Dak.
Angel Island, Cal.	David's Island, N. Y. H.	Lyon, Fort, Colo.	Mount Vernon B'ks, Ala.	Presidio of San Francisco, Cal.	Spokane, Fort, Wash.
Assininiboine, Fort, Mont.	Ellis, Fort, Mont.	Lapwai, Fort, Idaho.	Mitchell, Camp, Ga.		Shaw, Fort, Mont.
Benicia Barracks, Cal.	Gaston, Fort, Cal.	Lowell, Fort, Ariz.	McDowell, Fort, Ariz.	Reno, Fort, Ind. T.	Totten, Fort, Dak.
Brady, Fort, Mich.	Hale, Fort, Dak.	Mason, Fort, Cal.	Mojave, Fort, Ariz.	Randall, Fort, Dak.	Townsend, Fort, Wash.
Bidwell, Fort, Cal.	Hamilton, Fort, N. Y.	Madison Barracks, N. Y.	Niagara, Fort, N. Y.	Robinson, Fort, Nebr.	Union, Fort, N. Mex.
Bridger, Fort, Wyo.	Jefferson Barracks, Mo.	McDermitt, Fort, Nev.	Niobrara, Fort, Nebr.	Snelling, Fort, Minn.	Wingate, Fort, N. Mex.
Buford, Fort, Dak.	Klamath, Fort, Oreg.	McHenry, Fort, Md.	Pembina, Fort, Dak.	Saint Augustine, Fla.	Yates, Fort, Dak.

State weather services from which meteorological reports were received in time to be used in the preparation of the Monthly Weather Review for December, 1883.

Indiana State Weather Service, under direction of Mr. W. H. Ragan, Lafayette, Ind.
Missouri State Weather Service, under direction of Professor Francis E. Nipher, Saint Louis, Mo.
Tennessee State Weather Service, under direction of Hon. A. J. McWhirter Nashville, Tenn.
Nebraska State Weather Service, under direction of Mr. S. R. Thompson, Lincoln, Nebr.
Ohio State Weather Service, under direction of Professor T. C. Mendenhall, Columbus, Ohio.
Extracts have been used from records of the Central Pacific and Southern Pacific railways.

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